Primary FRCA: 450 MTFs and SBAs

SECOND EDITION

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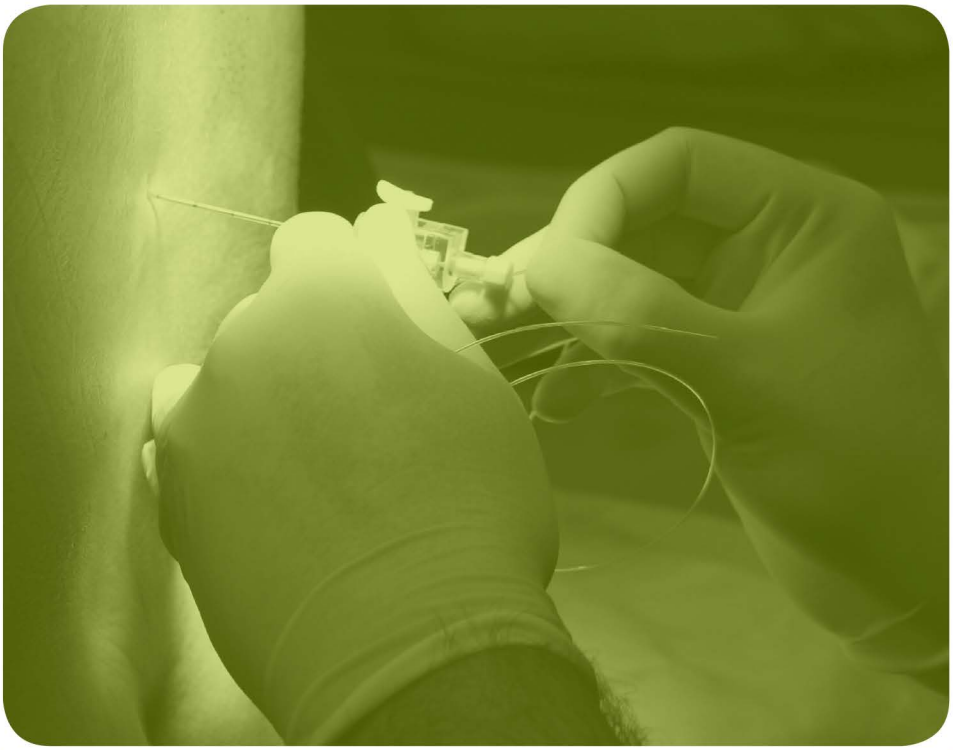

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Chapter 3

Mock paper 3

60 MTFs and 30 SBAs to be answered in three hours

Questions: MTFs

Answer each stem 'True' or 'False'.

1. The following statements regarding heart sounds are true:

- **A** In a healthy person, heart sounds are due to the opening and closing of the heart valves
- **B** The second heart sound comes immediately after a pause
- **C** The mitral and tricuspid valves close simultaneously
- **D** Splitting of the second heart sound suggests valvular abnormality
- **E** Third and fourth heart sounds are difficult to hear due to their high frequency

2. With regards to the mechanism of cardiac muscle contraction:

- **A** In the resting state, the actin-binding sites are blocked by troponin
- **B** Contraction is initiated by a rise in intracellular potassium
- **C** The myosin head attaches to the actin-binding site to initiate contraction
- **D** Energy for cross-bridge cycling is provided by adenosine diphosphate
- **E** The force of contraction is independent of the number of cross-bridges formed

3. Regarding baroreceptors:

- **A** They are mainly located in the carotid sinus and ascending aorta
- **B** The carotid sinus is found in the external carotid artery
- **C** Afferent fibres from the carotid sinus travel via the vagus nerve
- **D** They respond to stretch and not pressure
- **E** Baroreceptors in the carotid sinus are sensitive to mean arterial pressure and pulse pressure

4. The following statements regarding the effects on vascular smooth muscle are correct:

- **A** Acidosis causes vasoconstriction
- **B** Adenosine causes vasodilatation
- **C** Prostaglandin F causes vasodilatation
- **D** Prostacyclins cause vasodilatation
- **E** Serotonin causes vasoconstriction

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5. The following are true regarding oxygen consumption by the kidneys:

A It is about 100 mL of oxygen per minute
B The arteriovenous difference for oxygen is similar to the heart
C Oxygen consumption in the cortex is 20 times greater than in the medulla
D In the medulla energy metabolism is mainly anaerobic
E Renal oxygen consumption can be calculated using the Fick principle

6. Regarding the tubular transport of substances in the nephron:

A The initial process is filtration
B Hydrogen ions are actively reabsorbed with water
C It includes the passive transcellular excretion of the endogenous products of metabolism
D Exogenous substances are actively secreted
E Products of metabolism from tubular cells undergo active and passive cellular secretion into the tubular lumen

7. Regarding the hormonal control of salt and water excretion:

A Antidiuretic hormone (ADH) is secreted from the hypothalamus
B Atrial stretch receptors cause direct release of ADH
C ADH causes an increase in water reabsorption by the kidneys
D Salt excess results in release of ADH and aldosterone
E Atrial natriuretic peptide increases the renal reabsorption of sodium ions

8. Regarding acid/base balance:

A pH is the logarithmic measure of the effective hydrogen ion concentration
B Buffers act by fully neutralising acids and bases
C Haemoglobin is an important buffer
D Plasma proteins act as buffers in the blood
E Bicarbonate levels are controlled primarily by the lungs

9. Regarding lung compliance, which of the following are true:

A It varies with different lung volumes
B The pressure volume loop is sigmoid shaped during normal tidal volume
C It is increased in the elderly
D It is less during inflation than deflation when measured dynamically
E It requires knowledge of intrapleural pressures to calculate

10. Functional residual capacity:

A May be calculated using helium dilution methods
B Is reduced by positive end-expiratory pressure
C Is reduced during general anaesthesia
D Is approximately 1.5 L in adults
E Is the sum of residual volume and the inspiratory reserve volume

11. Regarding the alveolar–arterial oxygen tension difference:

A It is increased under general anaesthesia
B It is normally 0.5–1 kPa in room air

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C In the elderly it is greater
D It is reduced by sevoflurane
E May be decreased by right-to-left intracardiac shunts

12. Pulmonary vascular resistance:

A Is calculated using the Fick principle
B Requires knowledge of the right atrial pressure to calculate
C Is lowest at functional residual capacity
D Increases with pulmonary embolism
E Reduces with exercise

13. Regarding energy and metabolism:

A Fructose contains fewer calories per gram than glucose
B Fatty acids are an important substrate for gluconeogenesis
C Erythrocytes operate independently of the pentose phosphate pathway
D Fatty acids cannot enter the Krebs cycle
E Leptin stimulates appetite via the hypothalamus

14. Regarding hormones secreted by the thyroid gland:

A The follicular cells secrete thyroxine and calcitonin
B The thyroid gland is the only endocrine gland that stores its hormones in large quantities
C Peroxidase oxidises iodine to iodide, enabling the iodination of tyrosine
D 99% of T3 and T4 is bound to transport proteins in the blood
E T3 is more potent and secreted in larger quantities than T4

15. Regarding the adrenal gland:

A Cortisol is secreted by the adrenal medulla
B Noradrenaline is produced in greater quantity than adrenaline
C Chromaffin cell tumours are treated with octreotide in the first instance
D Multiple endocrine neoplasia type 1 is commonly associated with adrenal gland tumours
E Adrenocorticotrophic hormone levels are increased in tertiary adrenal insufficiency

16. The lower oesophageal sphincter:

A Is found in the oesophagus about 2–5 cm above the cardia
B Is anatomically the same as the rest of the oesophagus
C Is normally relaxed
D Relaxes when the peristaltic wave passes down the oesophagus
E Is functionally normal in achalasia of the cardia

17. Regarding the pancreas, which of the following are true:

A It secretes about 2 L of pancreatic juice per day
B Secretion is under the control of gastrin and secretin
C The stimulus for hormone secretion is a high pH and fat in the gastrointestinal tract

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D The bicarbonate in pancreatic juices activates pancreatic enzymes
E Trypsin and chymotrypsin are pancreatic enzymes

18. Cerebrospinal fluid:

A Has a volume of 150 mL
B Is more acidic than plasma
C Is secreted from the arachnoid villi
D Contains 2 g/L of albumin
E Glucose concentration is less than one-third than that of the serum

19. The sympathetic nervous system:

A Unmyelinated preganglionic efferent fibres have a thoracolumbar outflow
B Provides fibres to the facial nerve
C Has acetylcholine as a neurotransmitter
D Stimulates renin secretion
E Causes pupillary constriction

20. Regarding red blood cells, the following are true:

A Their circulating lifespan is 20 days
B Production is reduced in response to increased circulating red blood cells
C Mean corpuscular volume increases in iron deficiency
D They are multinucleated
E They contain enzymes for glycolysis

21. Regarding mammillary three-compartment models:

A The initial plasma concentration decline is due to metabolism
B The second and third compartments have an equilibrium constant of k23
C Distribution into the second compartment is faster than the third compartment
D Drug elimination is a linear process
E Drug clearance is out of either the central or second compartments

22. The following drugs need dose adjustment in renal failure:

A Hydralazine
B Enoximone
C Tramadol
D Phenytoin
E Atracurium

23. Regarding phase II metabolic processes:

A They include acetylation
B They aim to reduce water solubility of a drug
C They always render drugs inactive
D They only occur in the liver
E They may precede a phase I metabolic process

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24. Regarding isomerism:

A Atracurium is a racemic mixture of cis and transatracurium
B Ropivacaine is an enantiopure preparation
C Thiopental exhibits tautomerism
D Enflurane and isoflurane are optical isomers
E Cis-trans isomerism requires a C=C double bond

25. Regarding drug–receptor interactions, which of the following are true:

A Potency relates to how well a drug binds to a receptor
B Antagonists have an intrinsic activity of 0
C Efficacy is same as intrinsic activity
D Partial agonists may have maximal efficacy
E Agonists have a high receptor affinity

26. Regarding bupivacaine:

A In toxicity, the central nervous system is affected before the cardiovascular system
B Propofol is a suitable alternative to lipid emulsion in the management of bupivacaine toxicity
C At pH 7.4, it is more ionised than lidocaine
D It is less cardiotoxic than prilocaine
E It is metabolised directly by tissues

27. The following drugs undergo ester hydrolysis:

A Amethocaine
B Esmolol
C Lorazepam
D Phenytoin
E Mivacurium

28. Methohexital:

A Is a methylated thiobarbiturate
B Causes a less intense excitatory phase than thiopentone
C Should be avoided in patients with epilepsy
D Produces fewer complications than thiopentone following inadvertent arterial injection
E Has a lower incidence of hypersensitivity compared with thiopentone

29. Which of the following pharmacokinetic properties are true:

A Thiopentone undergoes hepatic oxidation to inactive metabolites
B Ketamine is highly protein bound
C Propofol is conjugated and metabolised by the liver
D Etomidate is metabolised by the liver to quinol and glucuronide
E Most of the unbound thiopentone is in the ionised form

30. Volatile anaesthetics are associated with the following:

A Isoflurane depresses minute volume and increases $P\mathrm{aCO}_2$
B Sevoflurane causes breath holding

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C Halothane decreases cerebral blood flow
D Desflurane sensitises the heart to catecholamines
E Enflurane can cause seizure activity in patients with epilepsy

31. Which of the following non-steroidal anti-inflammatory drugs are correctly classified:

A Tenoxicam is an acetic acid derivative
B Ibuprofen is a propionic acid
C Paracetamol is a para-aminophenol
D Diclofenac is an anthranilic acid derivative
E Ketorolac is an acetic acid derivative

32. Regarding the pharmacokinetic properties of morphine, which of the following is correct:

A It is a weak base
B It is well absorbed from the stomach
C It is highly lipid soluble
D It is only metabolised in the liver
E It is mostly metabolised to the active morphine-6-glucuronide

33. Which of the following prolongs the action of neuromuscular blocking drugs:

A Respiratory acidosis
B Hyperkalaemia
C Gentamicin
D Lidocaine
E Temperature of 38.4°C

34. Atracurium:

A Can be used for rapid sequence induction
B Is more potent than rocuronium
C Once removed from the refrigerator should be used within 15 minutes
D Is contraindicated in epilepsy
E Is beneficial in the management of raised intracranial pressure

35. Sugammadex:

A Is a δ-cyclodextrin
B Has no effect on vecuronium
C Has no active metabolites
D Is minimally plasma protein bound
E Is faster acting than neostigmine

36. Which of the following drugs act on GABA receptors:

A Ketamine
B Isoflurane
C Baclofen
D Lorazepam
E Naloxone

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37. Lithium:

A Has 100% oral bioavailability
B Is not bound to plasma proteins
C Prolongs depolarising and non-depolarising neuromuscular blockade
D Undergoes mainly hepatic metabolism
E Can cause thyroid dysfunction

38. Calcium channel antagonists:

A Interfere with the inward displacement of Ca^{2+} ions
B Depress phases III and IV of the cardiac action potential
C Are useful for treating ventricular arrhythmias
D Undergo minimal first-pass metabolism
E Increase smooth muscle contractility and peripheral resistance

39. The following are correctly classified:

A Furosemide is a loop diuretic
B Amiloride is a loop diuretic
C Bumetanide is a thiazide diuretic
D Acetazolamide is an aldosterone antagonist
E Metolazone is a thiazide diuretic

40. The following are true regarding antimicrobial drugs:

A Penicillins are bacteriostatic
B Cephalosporins contain a β-lactam ring
C Tetracyclines inhibit bacterial protein synthesis
D Aminoglycosides are ineffective against gram-negative organisms
E Macrolides are bactericidal and inhibit DNA synthesis

41. The following are true regarding electrical safety:

A Alternating currents cannot pass through a capacitor
B Class II equipment is earthed
C The resistance of a capacitor is proportional to the frequency of an alternating current
D Class I electrical equipment is of low voltage
E Class II equipment is double-insulated

42. Regarding electrodes used to detect biological signals:

A They are coated with silver chloride
B They typically have a high impedance to minimise mains interference
C Needle electrodes usually deliver better signals than electrode pads
D Movement artefacts are reduced by using a gel-covered foam pad on the electrode surface
E Skin impedance is reduced by wiping with alcohol solution

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43. Regarding different modes of surgical diathermy:

A The most efficient cutting waveform is a continuous sine wave
B Coagulation is best achieved with a continuous waveform at lower voltages that are required for cutting
C Desiccation is the destructive charring of tissue by arcing
D Cutting diathermy causes boiling of intracellular fluid
E Bipolar diathermy is better at coagulation than cutting

44. Concerning the principles of laser:

A Laser is an acronym for light amplification by stimulated emission of radiation
B Laser controls the way that energised atoms release electrons
C Light or electricity is used to create excited atoms
D Photons are released as the excited atoms relax
E Photons are of varying wavelengths

45. The following are derived from SI units:

A Ampere
B Watt
C Newton
D Mole
E Pascal

46. Regarding the principles of measurement:

A Extrapolation is measurement within the range over which an instrument has been calibrated
B Calibration of an instrument removes the chances of a systemic error
C An accurate measurement is precise and unbiased
D An exponential relationship cannot be changed into a linear one
E Calibration may use a reference such as standard measurement of length or weight

47. The following are disadvantages of humidification methods:

A Ultrasonic nebulisers deposit water in the breathing circuit
B Bubble humidifiers increase the work of breathing
C Humidifiers can cause bacterial contamination of the circuit
D Heat and moisture exchangers increase dead space
E Heated humidifiers can cause over-hydration

48. Concerning non-electrical techniques of temperature measurement, which of the following are true:

A Mercury thermometers are more suitable than alcohol thermometers at very high temperatures
B Alcohol thermometers have a linear scale
C Alcohol freezes at –39°C
D A Bourdon gauge is a type of dial thermometer
E A bimetallic strip thermometer works on the principles of heat capacity

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49. Regarding the storage of oxygen in hospitals, which of the following are true:

A It is stored in liquid form
B The critical temperature of oxygen is –160°C
C At –150°C, oxygen is a liquid
D The oxygen pipeline pressure is kept at about 7 bar
E A refrigeration unit is needed to keep the storage vessel cool

50. Regarding non-invasive blood pressure measurement, which of the following are true:

A When using oscillotonometry, diastolic pressure values are prone to inaccuracies
B Too large a cuff overestimates and too small a cuff underestimates blood pressure measurement
C Oscillometry requires the use of a double cuff
D In oscillometry, the maximum amplitude detected as the cuff is deflated is the systolic pressure
E Automated devices such as the DINAMAP (device for indirect non-invasive automatic mean arterial pressure) use oscillotonometry to measure the blood pressure

51. Regarding electrical shock:

A Pain is felt at 5 mA
B The severity does not depend on the current density
C Ventricular fibrillation is more likely if the current reaches the heart during repolarisation
D Antistatic shoes prevents the current from passing to earth
E 50 mA is sufficient to cause tonic myocardial contraction

52. Safety mechanisms on anaesthetic machines which minimise the risk of delivering unsafe gas mixtures include:

A Emergency oxygen flush
B Chain-link mechanism
C Schrader valves
D Paramagnetic analysers
E Pressure reducing valves

53. Tec Mark 5 vaporisers:

A Have a bypass stream fully saturated with vapour
B Contain bimetallic strips in the vaporising chamber
C Are coded blue for desflurane
D Have wicks and baffles to maximise vapour saturation
E Contain copper heat sinks

54. The following airway devices have oesophageal drainage ports:

A i-gel
B LMA ProSeal
C LMA Supreme

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D Combitube
E Intubating LMA

55. Examples of a T-piece breathing system include:

A Mapleson A
B Mapleson C
C Mapleson D
D Mapleson E
E Mapleson F

56. Oxygen in its gaseous form can be measured with:

A Galvanic cells
B Diamagnetism
C Raman scattering
D Polarography
E Infrared spectroscopy

57. Regarding filters, which of the following are true:

A Epidural filters have a pore size of 0.2 microns
B Blood giving set filters have a pore size of 2–18 microns
C Platelets can be administered through blood giving set filters
D A pore size of 25 microns filters most micro-organisms
E They may remove microaggregates

58. Concerning capnography, which of the following are true:

A End-tidal carbon dioxide can be higher than arterial carbon dioxide
B Absorption of infrared light is in the wavelength of 42.8 μm
C The rise time is the time for the sample to reach the analyser
D The sampling chamber contains glass windows
E Collision broadening reduces the measured amount of carbon dioxide

59. Regarding the DINAMAP (device for indirect non-invasive automatic mean arterial pressure), which of the following are true:

A It has a proximal occluding cuff
B It is accurate to +/– 0.5%
C The cuff bladder should be 40% of the arm circumference
D It utilises the principle of oscillometry
E Cuff deflation is at a rate of 6 mmHg per second

60. Defibrillators:

A Have 5000 V between capacitor plates
B Contain a diode
C Should be set to deliver an external unsynchronised shock of 4 J/kg in children
D Discharge alternating current from capacitors
E Have three switches

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Questions: SBAs

For each question, select the single best answer from the five options listed.

61. You have anaesthetised a fit 30-year-old, 70 kg, man for a laparoscopic appendicectomy. You have intubated his trachea with a size 8 tracheal tube secured at 22 cm at the lips and are ventilating his lungs via a circle system at a rate of 12 breaths per minute with tidal volumes of 500 mL and positive end-expiratory pressure (PEEP) of 5 cmH_2O.

Which one of the following manoeuvres is least likely to affect dead space?

A Reducing the amount of tubing in the circuit
B Reducing tidal volume to 350 mL
C Removing PEEP
D Advancing the tracheal tube to 24 cm at the lips
E Administering 200 μg of atropine sulphate

62. A 48-year-old woman is having a laparoscopic ovarian cystectomy during which the surgeon says they think the patient is bleeding. Her oxygen saturation is 96%, blood pressure 85/62 and heart rate 112 beats per minute.

What is the most appropriate immediate action?

A Perform an arterial blood gas sample
B Order one unit of blood
C Observe for changes
D Give a fluid challenge
E Tell the surgeon to end the case

63. A 34-year-old man presents with polyuria, polydipsia and confusion. His arterial blood gas shows pH 7.14; $PaCO_2$ 3.5 kPa; PAO_2 12.4 kPa; HCO_3^- 14.6 mmol/L; lactate 4.7 mmol/L; glucose 27.3 mmol/L.

What is the most likely underlying pathogenesis?

A Hyperosmolar non-ketotic coma
B Diabetes insipidus
C Diabetic ketoacidosis
D Salicylate toxicity
E Decompensated liver failure

64. A 6-year-old, 20 kg, girl presents with a 2-day history of vomiting and right iliac fossa pain. She is estimated to be severely dehydrated with a deficit of 10%.

What fluid regimen is most suitable to replace her fluid deficit?

A 1000 mL 0.9% NaCl in 6 hours
B 2000 mL 0.18% NaCl/4% glucose in 12 hours
C 400 mL Hartmann's solution in 12 hours
D 1000 mL 15% glucose in 24 hours
E 2000 mL 0.9% NaCl in 24 hours

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65. When floating a pulmonary artery catheter in a 75-year-old man, the pressure reading from the tip of the catheter is 25/2 mmHg.

The most likely position for the catheter would be?

A Right atrium
B Right ventricle
C Pulmonary artery
D Right internal jugular vein
E Left atrium

66. When using a cardiac catheter with incorporated electrodes, it must be designated to a type of electrical safety.

Which electrical safety class or type is the cardiac catheter most likely to belong to?

A Class 1
B Type B
C Class 3
D Type BF
E Type CF

67. You have anaesthetised a patient for a laparoscopic cholecystectomy. Despite three attempts at direct laryngoscopy, you fail to intubate the trachea. The oxygen saturation is 99%.

Which of the following is the most appropriate next step in this patient's airway management?

A Facemask ventilation using an oropharyngeal airway
B Requesting a videolaryngoscope for your final attempt at intubation
C Insertion of a supraglottic airway device
D Allowing the patient to wake
E Await senior assistance

68. A 63-year-old man with severe left ventricular failure has an intra-aortic balloon pump in situ.

Which of the following is true of a correctly functioning intra-aortic balloon pump?

A Inflation in systole improves systolic blood pressure
B It should be synchronised with the ECG to avoid the R-on-T phenomenon
C Diastolic blood pressure exceeds systolic blood pressure
D The use of helium is now avoided due to the risk of gas embolism
E It is a useful tool in preoptimising patients with severe aortic regurgitation

69. A 75-year-old man is having a laparotomy for excision of a large bowel carcinoma. He has a thoracic epidural in place and is being actively warmed by using a warm air blanket and infusion of warm fluids.

Which of the following is *least* likely to be a consequence of mild peri-operative hypothermia?

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ISBN 978-1-909836-95-2