



DA (SA)

THE COLLEGES OF MEDICINE OF SOUTH AFRICA

Incorporated Association not for gain
Reg No 1955/000003/08

Examination for the Diploma in Anaesthetics
of the College of Anaesthetists of South Africa



10 July 2019

Paper 1

(3 hours)

All questions to be answered.

Please answer Questions 1 and 2 in ONE booklet

- 1 Regarding the World Health Organisation (WHO) surgical safety checklist
- a) List three advantages of the surgical safety checklist. (3)
 - b) List three barriers to implementation of the surgical safety checklist. (3)
 - c) At which points in the peri-operative period is the checklist done? (3)
 - d) List the safety factors that need to be checked at the first phase of the checklist. (6)
- [15]
- 2 Regarding informed consent
- a) List the 4 elements of informed consent. (4)
 - b) State who may grant consent under the following scenarios
 - i) A 15-year-old girl presents for an elective termination of pregnancy. (1)
 - ii) An 11-year-old boy of sound mind and sufficient maturity requires an urgent laparotomy for a perforated appendix. (1)
 - iii) An orphaned 21-year-old patient with mental retardation, and no other family members, requires an elective inguinal hernia repair. (1)
 - c) List the four biomedical ethical principles and briefly explain each. (8)
- [15]

Please answer Question 3 in ONE booklet

- 3 A 45-year-old Jehovah's Witness is booked for a laparoscopic assisted vaginal hysterectomy for a large multifibroid uterus with the potential of massive blood loss
- a) Discuss your pre-operative counselling with respect to blood product usage. (5)
 - b) State the fully expanded oxygen delivery (DO_2) equation. (5)
 - c) Regarding the Oxygen-Haemoglobin dissociation curve
 - i) Draw and label the Oxygen-Haemoglobin dissociation curve. (4)
 - ii) List 3 factors that shift the curve to the right. (3)
 - iii) Define the Bohr effect. (2)
 - iv) Define the Haldane effect. (2)
 - d) List 6 intra-operative blood conservation strategies that you as the anaesthetist could consider implementing. (6)
 - e) List 3 post-operative blood conservation strategies. (3)
- [30]

Please answer Questions 4, 5 and 6 in ONE booklet

- 4 Regarding amniotic fluid embolism (AFE)
- What is the pathophysiological mechanism? (1)
 - List 4 diagnostic features of AFE. (4)
 - How would you manage a patient with AFE? (5)
- [10]
- 5 Draw and complete the following table regarding obstetric related causes/mechanisms of peri-operative maternal mortality and provide one example of each.

Cause/ Mechanism	Example
Example: Haemorrhage	Example: APH

[10]

- 6 Regarding labour analgesia
- List 4 non-pharmacological techniques of labour analgesia. (4)
 - List 4 different pharmacological techniques and state 1 example for each. (4)
 - When using an epidural, which sensory dermatome levels should be blocked during the 1st and 2nd stages of labour?
 - 1st stage. (1)
 - 2nd stage. (1)
- [10]

Please answer question 7 in ONE booklet

- 7 A 65-year-old male patient is booked for surgery for an incarcerated inguinal hernia. He has a background history of hypertension and cardiac failure. He is classified as a New York Heart Association (NYHA) class 3
- Differentiate between systolic and diastolic cardiac failure. (4)
 - Describe the clinical features of NYHA class 3. (2)
 - Briefly explain cardiac failure using the Frank-Starling Law of the heart. (4)
 - Describe 2 compensatory mechanisms of heart failure and give a reason for each mechanism. (4)
 - Name 4 classes of drugs used for the management of heart failure. State the peri-operative anaesthetic concerns with each class of drug. (8)

- f) What abnormalities would you expect to find on the following investigations?
 - i) ECG. (2)
 - ii) Chest X-ray. (2)
 - iii) Echo. (2)
 - g) What is the peri-operative role of B-type Natriuretic Peptide (BNP)? (2)
- [30]

Please answer Question 8 in ONE booklet

- 8 a) What is the Blood-brain barrier comprised of? (2)
 - b) State 4 factors that determine the passage of substances across the Blood-brain barrier. (4)
 - c) List 6 factors that may disrupt the Blood-brain barrier. (6)
 - d) Describe the cellular changes that take place in the brain with cerebral ischaemia. (3)
 - e) Regarding the time period between a cerebrovascular accident (CVA) and elective surgery, define the following:
 - i) High risk period. (1)
 - ii) Low risk period. (1)
 - f) What are your pre-operative concerns in a patient who requires urgent surgery within the high risk period following a CVA? (5)
 - g) What are your intra-operative neuroprotective strategies when anaesthetising a patient who has had a CVA? (8)
- [30]

Please answer Questions 9 and 10 in ONE booklet

- 9 a) Draw and complete the table below listing the 3 nerves that innervate the larynx and state the effects of a unilateral and bilateral nerve injury. (9)

Nerve	Unilateral nerve injury	Bilateral nerve injury

- b) List 4 indications for performing a tracheostomy. (4)
 - c) Discuss the physiological advantages of a tracheostomy on the respiratory system. (2)
 - d) List 5 possible intra-operative complications when performing a tracheostomy on a patient that is intubated and being ventilated (5)
- [20]

- 10 With regard to airway fires
 - a) What are the components of the fire triad? (3)
 - b) List the immediate steps in the management of an airway fire. (7)
- [10]

Please answer Question 11 in ONE booklet

- 11 A 3-year-old boy is booked for a circumcision as a day-case procedure for 08:00 am the next day. The child has no co-morbidities, no previous anaesthetic history and no allergies.
- Estimate the weight of this child. (Show calculations) (2)
 - What would you advise the parents in terms of pre-operative fasting guidelines? (3)
 - Give a comprehensive premedication prescription to be followed by the sister, once the patient has been admitted to the ward at 07:30 am. (3)
 - Calculate the hourly maintenance fluid rate for this child intra-operatively. (Show calculations) (3)
 - Upon arrival to the recovery room the child wakes up crying and thrashing about. List 6 potential causes and briefly describe how would you manage each differential. (12)
 - What post-operative medication (including dose and frequency) would you prescribe to be taken at home? (4)
 - State 3 reasons why this child may require admission overnight. (3)
- [30]

Please answer Question 12 in ONE booklet

- 12 A 20-year-old patient is booked for a laparotomy for a ruptured appendix. Despite adequate fluid resuscitation this patient remains hypotensive
- List the 4 types of shock. (4)
 - What is the most likely cause of shock in this patient? (1)
 - How would you manage this patient? (5)
 - Treatment is commenced with co-amoxi/clav (Augmentin®)
 - Would this have been the correct antibiotic of choice intra-operatively? Motivate your answer (2)
 - What are the components of co-amoxi/clav and the mechanism of action of each component? (4)
 - What is the adult dose and dosage interval for co-amoxi/clav? Motivate your answer in terms of the pharmacokinetics of this antibiotic. (4)
 - List 2 goals of antimicrobial stewardship. (2)
 - List 3 factors to consider when prescribing a treatment antibiotic for any patient. (3)
 - Subsequently, this patient develops an acute kidney injury (AKI) with a creatinine of 420µmol/L and passes no urine for 24 hours
 - Classify the stage of AKI. (1)
 - List 4 indications for acute renal replacement therapy. (4)
- [30]

Please answer question 13 in ONE booklet

- 13 A 40-year-old woman is booked for an open reduction and internal fixation of her left femur. She is a known asthmatic
- List 3 drugs and doses for intra-operative systemic analgesia for this patient. (6)
 - State 2 peripheral nerve block options for this patient. (2)
 - How do local anaesthetics work? (2)
 - Categorise and describe the signs and symptoms of local anaesthetic systemic toxicity. (6)
 - Describe how you would administer 20% Intralipid® to a patient who has life threatening symptoms of local anaesthetic systemic toxicity. (4)

- f) Write a patient controlled analgesic (PCA) prescription for the above patient. (4)
- g) List 3 post-operative potential PCA side effects and the pharmacological management of these side effects. (6)
- [30]

Please answer Question 14 in ONE booklet

- 14 A critically ill patient requires transport to another hospital via road ambulance and you are required to accompany the patient. The patient is intubated and ventilated.
- a) List 5 **patient-related** adverse events associated with the transfer of a critically ill patient in an ambulance. (5)
- b) List 5 **non-patient related** logistical challenges specific to the road transfer of a patient in an ambulance. (5)
- c) With regards to drugs used for sedation of a critically ill patient, complete numbers 1 to 20 shown in the table below. (20)

Drug	Drug Class	Receptor	Effect on respiratory system	Effect on Blood pressure	Analgesia (Y / N)
Propofol		(1)	(2)	(3)	(4)
Ketamine	(5)	(6)	(7)	(8)	(9)
Morphine		(10)	(11)		(12)
Midazolam	(13)	(14)		(15)	(16)
Dexmedetomidine		(17)	(18)	(19)	(20)

[30]



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Paper 3

Data Interpretation

(2 hours)
(Total 200)

Candidate number: _____

Instructions

Questions 1 – 4 (40 marks)

There are five booklets for this examination

Answer all questions in the booklet and hand in the whole booklet at the end of the examination. Do not tear off or remove any pages.

Not all questions have an accompanying picture.

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NB. Fill in your candidate number above.

Question 1

A 60-year-old male is booked for an elective inguinal hernia repair. He has atrial fibrillation and is currently on atenolol and warfarin. His blood results are as follows:

PT 20 seconds (Normal = 10 - 13 seconds)
aPTT 35 seconds (Normal = 25 - 45 seconds)
INR 5,3
Platelets $190 \times 10^9/L$
Hb 12g/dL

- a) How would you manage this patient's INR if his surgery is in 1 week? (4)

- b) His hernia suddenly becomes strangulated and requires urgent surgical intervention. The INR is now 4,5. List 3 options to correct the INR. (3)

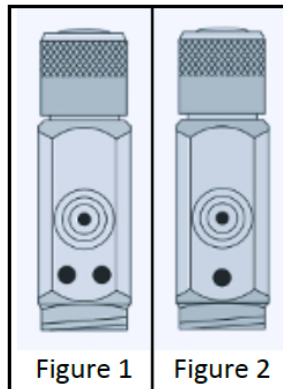
- c) How would you manage his anti-coagulation therapy post-operatively? (3)

[10]

Question 2

a) Complete the following table with regards to gas cylinder colour coding in South Africa. (5)

Cylinder description	Contents
Black with white shoulders	
Black with black and white shoulders	
Blue with blue shoulders	
Blue with white shoulders	
Green	



b) State which cylinders are represented by the Pin Index Safety System in the picture above. Figure 1. (1)

Figure 2. (1)

c) Provide normal values for the following: Oxygen pipeline pressure. (1)

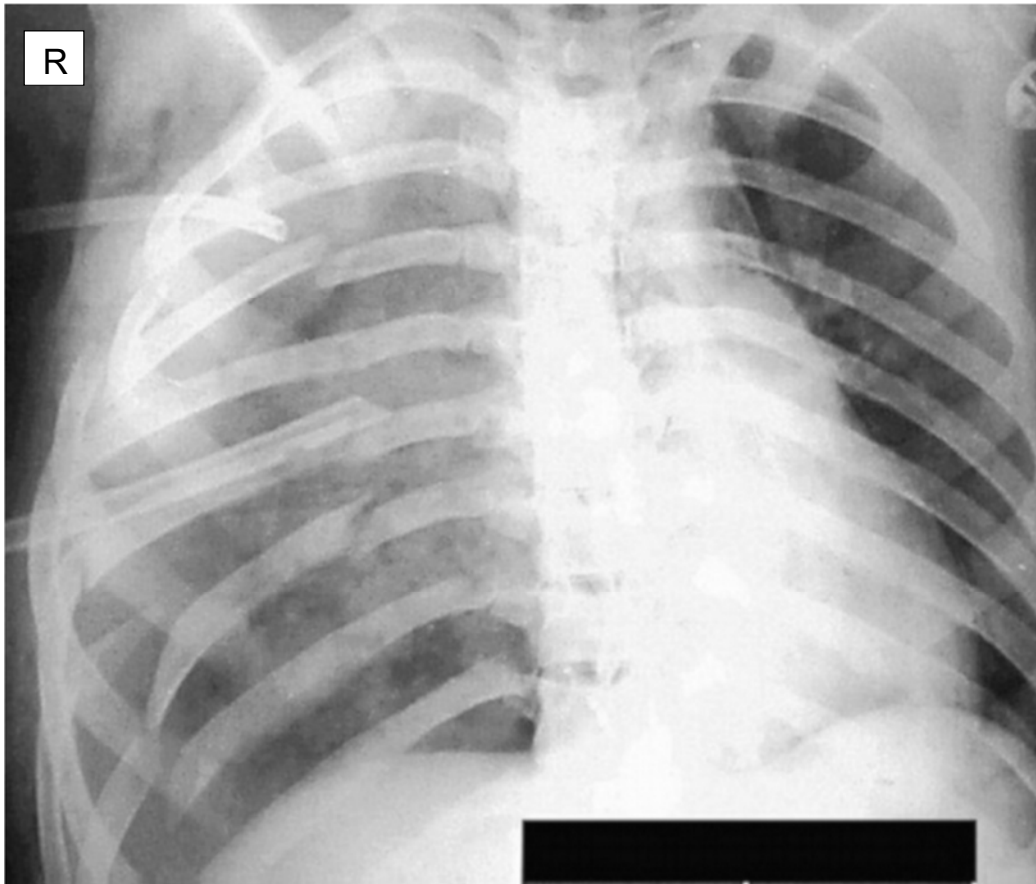
Pressure of a full oxygen cylinder. (1)

d) How would you determine the residual volume of a nitrous oxide cylinder? (1)

[10]

Question 3

A 20-year-old patient was an unrestrained driver in a motor vehicle collision who sustained isolated blunt chest trauma. His chest x-ray is shown below.



- a) List 4 abnormalities on the chest x-ray above. (4)

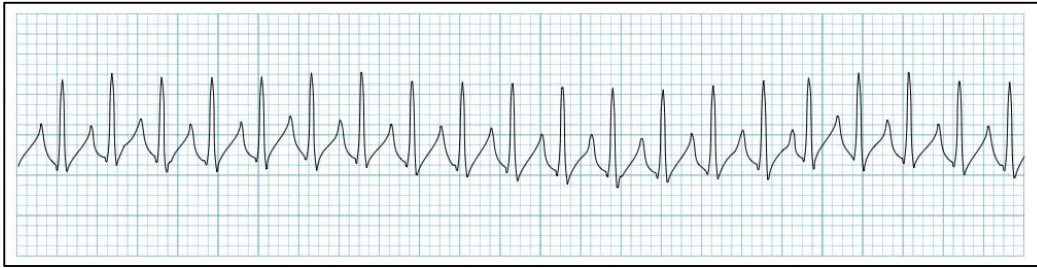
b) What are your analgesic options for this patient? (3)

c) List 3 other injuries this patient could have sustained that may be associated with blunt chest trauma. (3)

[10]

Question 4

The following is a rhythm strip of a patient in a high dependency unit. He is currently awake and alert with a blood pressure of 110/75.



a) What is the diagnosis? (1)

b) Briefly describe your initial management of this patient. (6)

c) Your management above fails and 10 minutes later the patient becomes confused and hypotensive. Briefly describe your subsequent management. (3)



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Questions 5 – 8 (40 marks)

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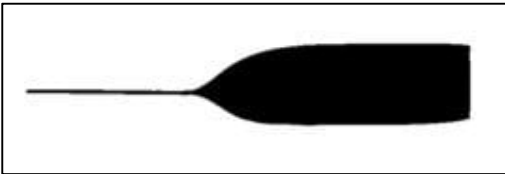
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Question 5**Normal Thromboelastography (TEG) trace**

With reference to the above normal Thromboelastography (TEG) trace, answer the questions that follow.

Trace A

- a) What TEG parameters are abnormal in Trace A? (2)

- b) What is the patient's underlying abnormality? (1)

- c) State the management for this abnormality. (1)

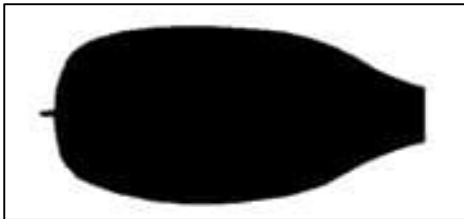
Trace B



d) What is the underlying abnormality in Trace B? (1)

e) How would you correct this abnormality? (2)

Trace C



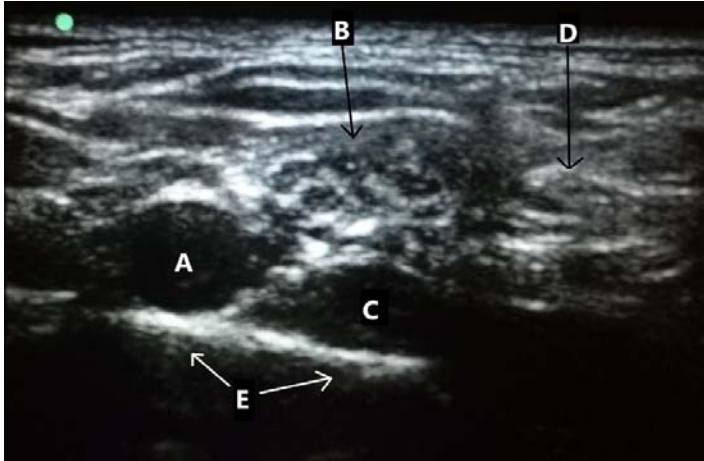
f) List 2 abnormalities shown in Trace C. (2)

g) How would you manage this abnormality? (1)

[10]

Question 6

The image below shows the sonoanatomy of the supraclavicular approach to the brachial plexus.



- a) Provide the following labels: (5)

A = _____

B = _____

C = _____

D = _____

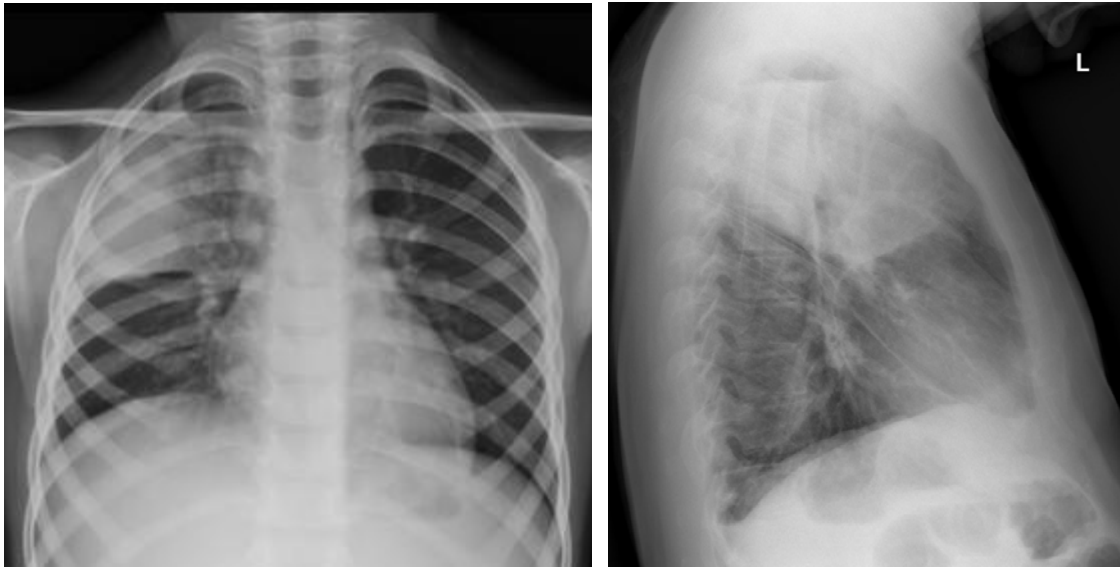
E (as indicated by the white arrows) = _____

- b) List 3 complications specific to this brachial plexus block approach. (3)

- c) List 2 ways of distinguishing between an artery and a vein using an ultrasound. (2)

[10]

Question 7



a) What is the diagnosis on the above x-rays? (2)

b) List 2 x-ray features that support your diagnosis. (2)

c) List 2 other differential diagnoses for the above x-ray. (2)

d) What peri-operative airway complications is this patient at risk of? (4)

[10]

Question 8

Regarding the following Arterial Blood Gas:

pH: 7.25

pO₂: 9.4 kPa / 70.5 mmHg

pCO₂: 7.0 kPa / 52.5 mmHg

HCO₃: 27.5 mmol/L

BE: 2.1 mmol/L

- a) Fully describe the acid-base abnormality above. (2)

- b) State 1 cause of the above abnormality. (1)

Regarding the following Arterial Blood Gas:

pH: 7.35

pO₂: 12 kPa / 90 mmHg

pCO₂: 4,3 kPa / 32 mmHg

HCO₃: 16 mmol/L

BE: -8 mmol/L

Na: 140 mmol/L

Cl: 100 mmol/L

K: 6 mmol/L

- c) Determine if there is appropriate respiratory compensation in the ABG above. (Show all calculations) (3)

- d) Calculate the anion gap. (2)

- e) Fully describe the acid-base abnormality. (2)



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Questions 9 – 12 (40 marks)

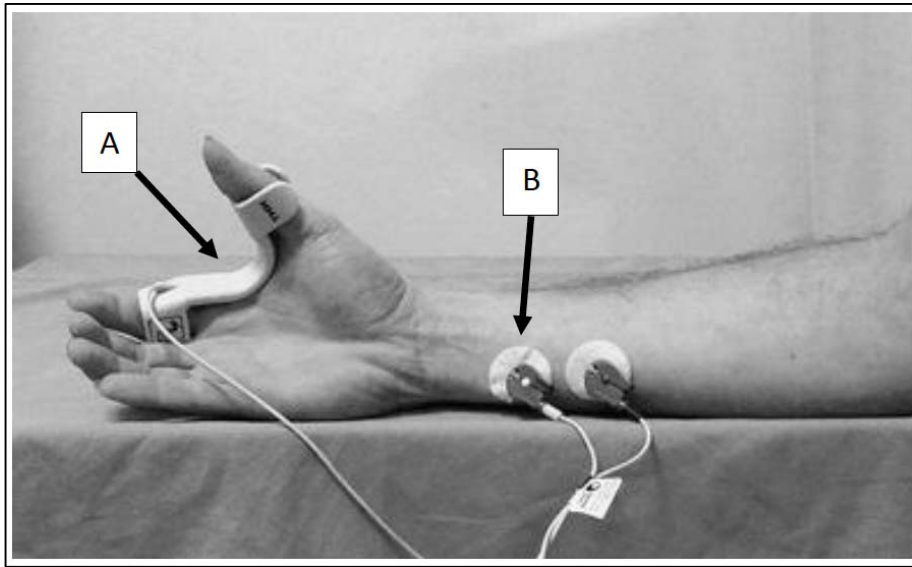
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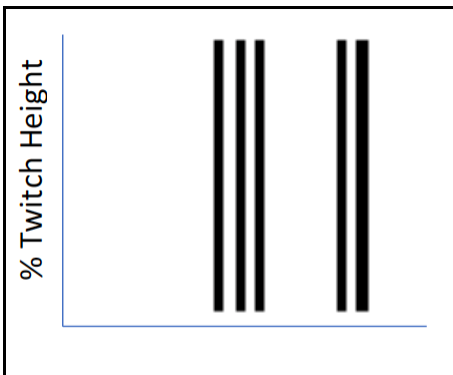
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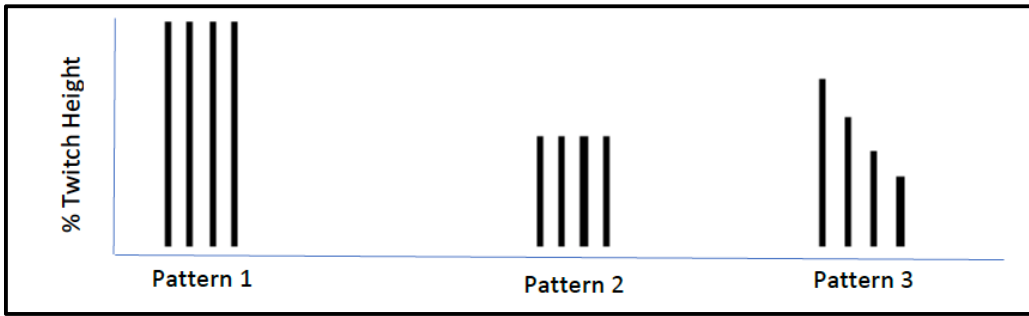
Question 9

- a) Identify the device labelled A in the picture above. (1)

- b) What colour electrode is positioned distally (Label B) in the figure above? (1)



- c) Identify the pattern above and state one use of this pattern. (2)



- d) Identify Pattern 1 in the figure above. (1)

- e) State one drug that may result in Pattern 2 above. (1)

- f) State one drug that may result in Pattern 3 above. (1)

- g) What is the pathophysiological mechanism that produces pattern 3? (2)



h) What phenomenon is demonstrated in the above pattern? (1)

[10]

Question 10

The x-ray below is of a 64-year-old lady who is booked for a hip replacement.



a) What is the most likely systemic disease? (1)

b) What are the airway manifestations and considerations of this disease? (5)

- c) List two chronic drugs this patient may be prescribed for the condition above and state one possible long-term side effect of each drug. (4)

[10]

Question 11

A 50-year-old lady (weight 60kg) has a pre-operative Na^+ of 120mmol/L.

- a) Name 3 causes of hyponatraemia with a decreased extra cellular fluid volume. (3)

- b) Calculate the volume of 0.9% NaCl that would be needed to increase the Na^+ to 130mmol/L (Show calculations). (4)

- c) Based on a correction rate of 0.5mmol/L/hr, what infusion rate in mL/hr would you run the 0.9% NaCl, and over how many hours would you replace it? (Show calculations). (3)

[10]

Question 12

A 64-year-old gentleman is having a transmetatarsal amputation under general anaesthesia. The patient is known with hypertension, Type I diabetes mellitus, peripheral vascular disease and has had a previous cerebrovascular accident (CVA). He has a 40-pack-year history of smoking. His intra-operative vitals are shown below.



- a) List the ECG abnormalities in the figure above. (2)

- b) List two possible causes for these ECG abnormalities. (2)

c) Briefly describe your post-operative management of this patient. (4)

d) Which 2 risk factors of the Revised Cardiac Risk Index does this patient have? (2)



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Questions 13 – 16 (40 marks)

There are five booklets for this examination

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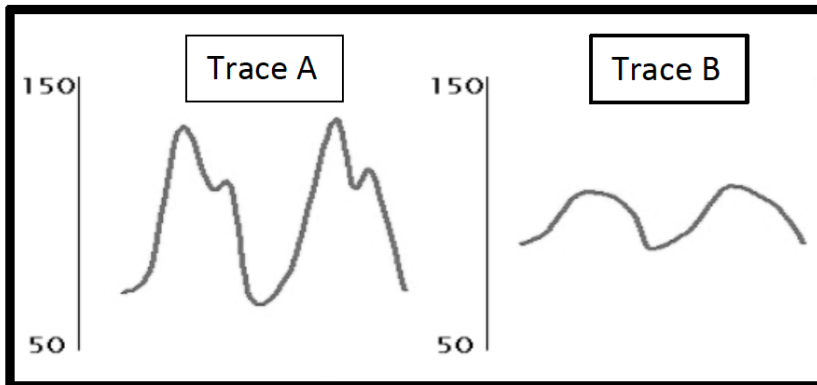
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Question 13

- a) List 3 indications for inserting an arterial line. (3)



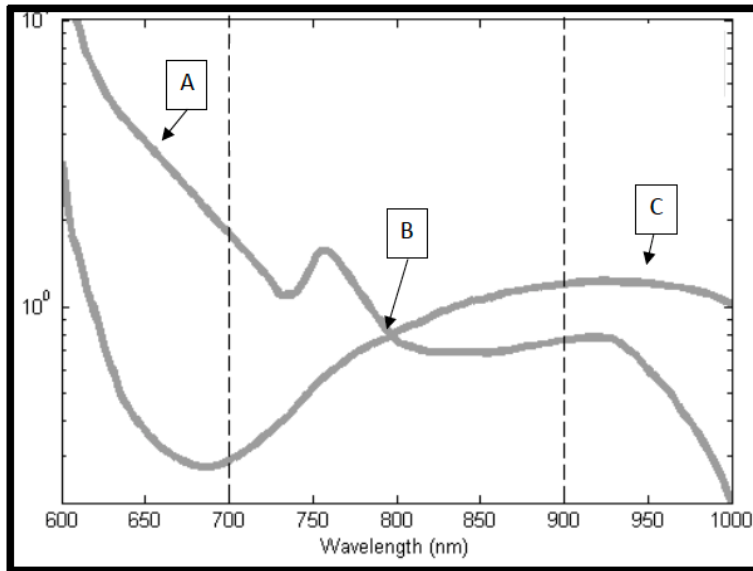
- b) Regarding the arterial waveform above, state the physical principle that results in the change from Trace A to Trace B. (1)

- c) State 3 ways in which the blood pressure measurement may be affected by the principle stated in question (b) above. (3)

- d) List 3 causes that may result in Trace B above. (3)

[10]

Question 14



a) Complete the labels shown in the figure above. (3)

A – _____

 B – _____

 C – _____

b) If the oxygen saturation on an arterial blood gas shows 100% while the pulse oximeter monitor reads 75%, state one cause for this difference. (1)

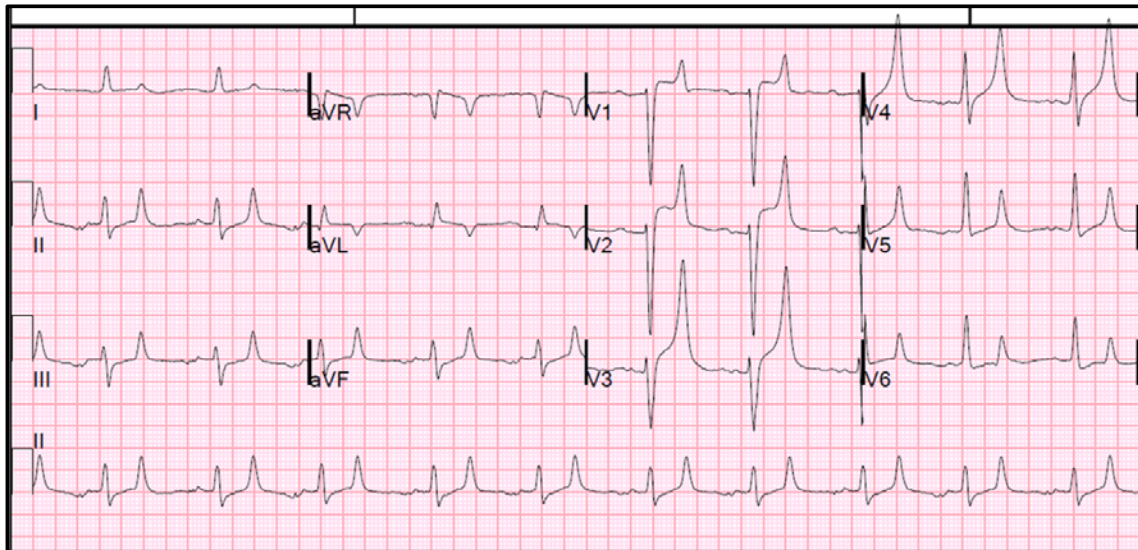
c) If the oxygen saturation on an arterial blood gas shows 75% while the pulse oximeter monitor reads 90%, state one cause for this difference and explain why this occurs. (3)

- d) List 3 other artifacts that may affect the pulse oximeter reading. (3)

[10]

Question 15

A 40-year-old gentleman presenting with an acute limb ischaemia with a compartment syndrome is booked for a fasciotomy. His ECG is shown below.



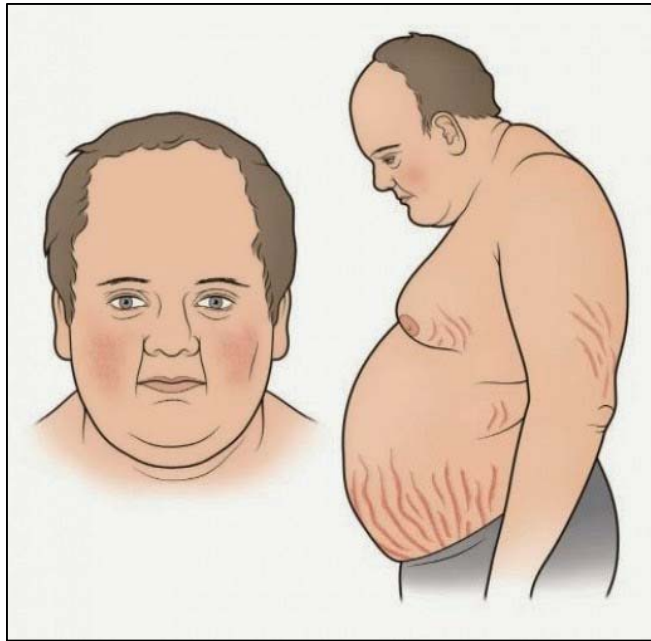
- a) What diagnosis is shown in the ECG above? (1)

- b) State the most likely cause of the abnormality listed above. (1)

- c) How would you manage this patient based on the ECG above? (5)

- d) At the time of the fasciotomy and release of the compartment syndrome, the blood pressure suddenly drops requiring an inotropic infusion. Explain why this has occurred. (3)

[10]

Question 16

The picture above is of a patient who presents for a laparoscopic cholecystectomy. His blood results are as follows:

Blood Tests	Result
Na	140 mmol/L
K	2.7 mmol/L
Cl	90 mmol/L
Bicarbonate	32 mmol/L
Urea	9.1 mmol/L
Creatinine	80 μ mol/L

- a) What is the most likely diagnosis of this patient? (1)

- b) List and explain the abnormalities in the blood results above. (3)

c) List 6 intra-operative concerns when managing a patient with this diagnosis. (6)

[10]



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Questions 17 – 20 (40 marks)

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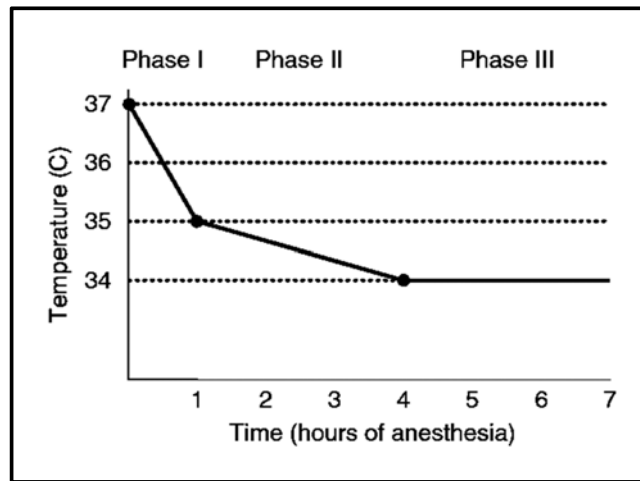
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Question 17

The graph below is of a 2-year-old child undergoing a laparotomy for bowel obstruction under general anaesthesia.



- a) Briefly explain what causes the 3 phases illustrated above? (3)

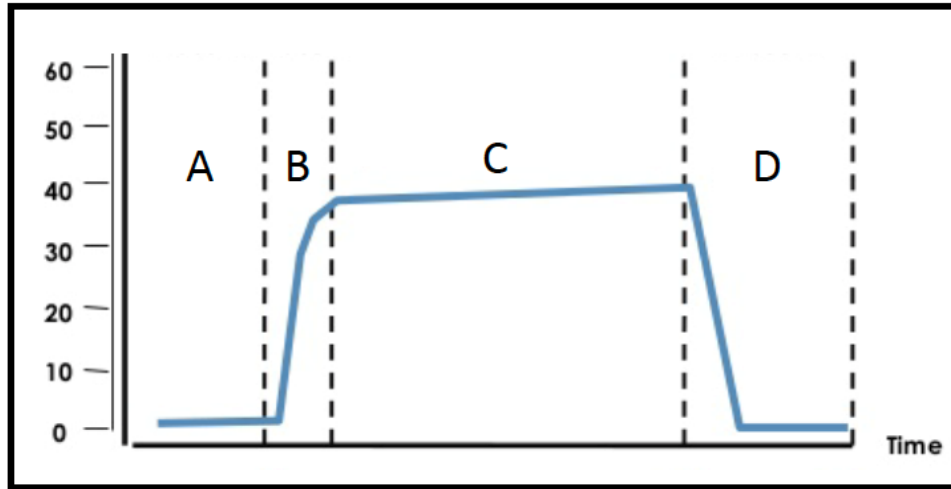
- b) What are the potential peri-operative consequences of hypothermia? (4)

c) How may intra-operative hypothermia be prevented? (3)

[10]

Question 18

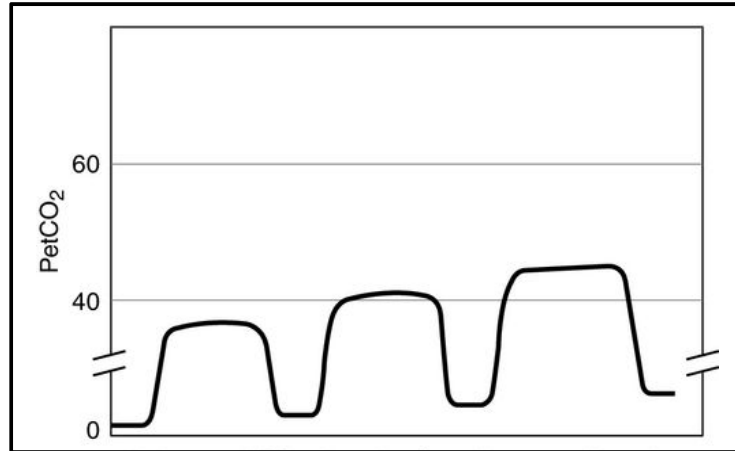
The figure below is of a normal capnography trace.



a) Provide labels for A, B, C and D in the figure above.

(4)

The diagram below shows a capnograph of a patient under anaesthesia with a circle system.



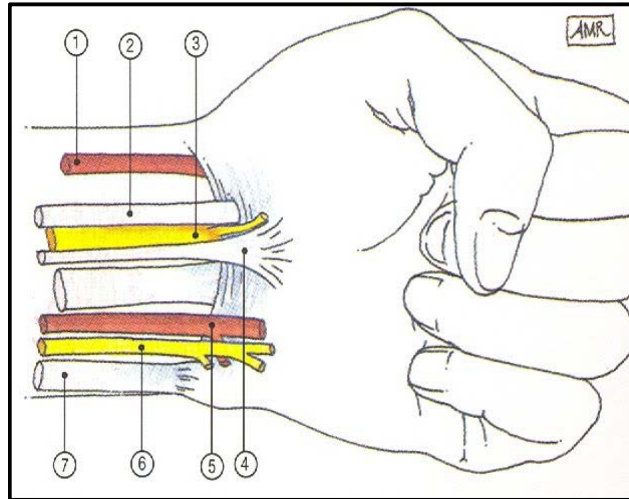
- b) What is the abnormality on the capnograph above? (2)

- c) List 2 causes for this abnormality. (2)

- d) How will you manage this abnormality? (2)

[10]

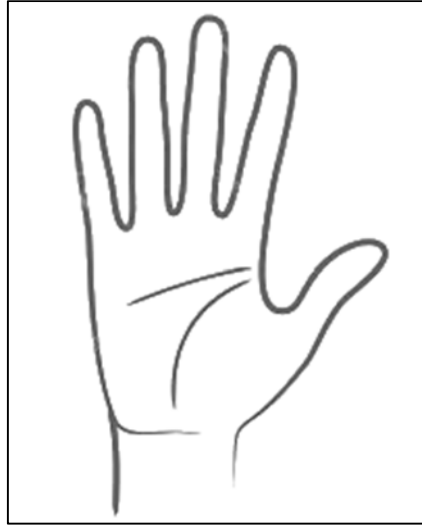
Question 19



a) Provide labels for 1 to 7 shown in the figure above. (7)

b) What is the anatomical landmark for blocking the median nerve? (1)

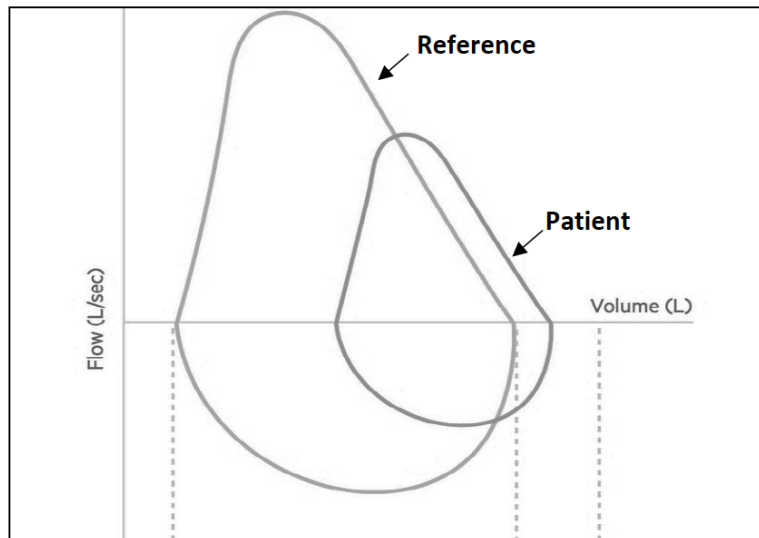
- c) Shade-in on the figure below the palmar sensory distribution of the median nerve. (2)



[10]

Question 20

A 55-year-old lady presents for plating of the proximal humerus. Her flow volume loop is shown below.



- a) Describe the abnormalities on the flow volume loop above. (4)

- b) What respiratory disease pattern do these abnormalities suggest? (1)

- c) List 3 causes of the above respiratory disease pattern. (3)

- d) Complete the table below regarding how you would adjust the ventilator based on the patient's flow-volume loop above. (2)

	Current	New setting
Respiratory rate	12	
Tidal volume	7ml/kg	

[10]