



**PROGRAM** : *BIOMEDICAL TECHNOLOGY*

**MODULE** : **Chemical Pathology III**

**CODE** : **CPP3112**

**DATE** : 17 JULY 2019  
SUPPLEMENTARY (SSA) EXAMINATION

**DURATION** : 180 MINUTES

**WEIGHT** : 50: 50

**TOTAL MARKS** : 185

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**EXAMINER** : W. KRUGER

**MODERATOR** : I. WAINER

**NUMBER OF PAGES** : 11 INCLUDING FRONT PAGE

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**INSTRUCTIONS** : QUESTION PAPER MUST BE HANDED IN

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**REQUIREMENTS** : 1 X EXAMINATION SCRIPT  
: 1 X CALCULATOR

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**INSTRUCTIONS TO CANDIDATES:**

1. THIS PAPER CONSISTS OF TWO SECTIONS.
2. EVERY SECTION MUST BE ANSWERED IN THE EXAMINATION ANSWER SCRIPT, WHICH ARE PROVIDED.

**SECTION A**

**Question 1- Choose the correct answer (s)**

**NB\*- There could be more than one correct answer- only write down the number and corresponding answers in your script**

- 1.1 The following statements about amniotic fluid are correct: (3)
- a. Decreased L/S ratio observed in RDS.
  - b. Sufficient levels of Phosphatidylglycerol is an indication of lung maturity
  - c. A ratio of 50 to 70 mg surfactant per gram of albumin is considered mature.
  - d. Subsequent RDS is very unlikely with an FSI value of 20 or lower.
  - e. Babies of diabetic mothers can develop RDS with L/S ratios < 1.0.
- 1.2 The following are TRUE related to reducing substances: (3)
- a. Ascorbic acid reduces copper in a hot alkaline solution.
  - b. Reducing substances have an active aldehyde or glycerol group.
  - c. Sucrose (table sugar) is a reducing substance.
  - d. Done on babies to test for lactose intolerance.
  - e. Positive results are seen in patients with G6PD.
- 1.3 The following statements about lipids in the blood are correct: (2)
- a. An HDL cholesterol concentration of <0.9mmol/L is abnormally low.
  - b. After myocardial infarction, blood must be taken within 48 hours if representative results are to be obtained.
  - c. The ideal cholesterol concentration is <6.5mmol/L
  - d. The molar ratio HDL cholesterol/total cholesterol should ideally be >0.10
  - e. Triglyceride concentration can be increased by recent food intake.
- 1.4 The following are True related to reducing substances: (2)
- a. Reducing substances have an active aldehyde or glycerol group.
  - b. Ascorbic acid reduces copper in a hot alkaline solution.
  - c. Sucrose (table sugar) is a reducing substance.
  - d. Done on babies to test for diabetes.
  - e. Positive results are seen in patients with G6PD.
- 1.5 The following statements about lipids in the blood are correct: (2)
- a. After myocardial infarction, blood must be taken within 48 hours if representative results are to be obtained.
  - b. An HDL cholesterol concentration of <0.9mmol/L is abnormally low.
  - c. The ideal cholesterol concentration is <6.5mmol/L.
  - d. The molar ratio HDL cholesterol/total cholesterol should ideally be >0.10.
  - e. Triglyceride concentration can be increased by recent food intake.
- 1.6 The following statements about HDL are correct: (2)
- a. HDL transport excess cholesterol from the liver to liver.
  - b. Facilitate clearance of chylomicron remnants and IDL.
  - c. Facilitate lipolysis of IDL (activator of LPL).
  - d. Inflammatory response by inhibition of LDL oxidation.
  - e. High levels give rise to CHD.

- 1.7 The following statements about fatty acids are correct: (2)
- a. Components of other lipids.
  - b. Saturated fatty acids are more common in nature.
  - c. In hyperinsulinemic hypoglycemia FFA increased.
  - d. Fecal fatty acids - detect malabsorption and pancreatic disorders.
  - e. In disorders of fatty acid oxidation the FFA is elevated and positive ketones.
- 1.8 Which of the statements about Copper is NOT true: (3)
- a. Copper is an essential mineral.
  - b. 20% of copper is through dietary intake.
  - c. Deficiency of copper is associated with Wilson's disease.
  - d. Copper is a component of several metalloenzymes.
  - e. In Copper toxicity patients presents with a decreased in skin pigmentation.
- 1.9 Phenytoin (3)
- a. Could cause severe hypotension.
  - b. Indicated for partial seizures.
  - c. Reduces sodium, potassium and calcium currents across neuronal membranes.
  - d. Metabolized in liver and has a long half-life.
  - e. Tested only on urine samples.
- 1.10 Drug therapy strategies for reducing lipid levels includes (3)
- a. Enhances utilization of lipoproteins.
  - b. Inhibits synthesis of lipoproteins.
  - c. Reduce endogenous cholesterol.
  - d. Reduce cholesterol excretion.
  - e. Usually increases HDL serum concentrations.

**TOTAL QUESTION 1= 25**

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**QUESTION 2**

**Indicate if the following statements are True or False AND supply a reason for your answer in each.**

- 2.1 Exudates are fluids that accumulate because of increased hydrostatic pressure in the capillaries. (2)
- 2.2 In RSD the L/S ratio is significantly decreased. (2)
- 2.3 Chylomicrons transport endogenous triglyceride to the liver. (2)
- 2.4 The additive used for the collection of fasting glucose is a sodium citrate tube. (3)
- 2.5 An increased level of urinary delta-ALA may indicate lead poisoning. (2)
- 2.6 Ferritin can be increased in people with inflammation or infection. (2)
- 2.7 DM Type 1 patient usually presents with a metabolic acidosis. (3)

**TOTAL QUESTION 2= 16**

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**TOTAL SECTION A = 41**

**SECTION B**

**QUESTION 1**

Patient		Mr. Khumalo		Age:		56					
Weight		N/A		Height		N/A		Body surface area		N/A	
Clinical history			A 56-year old Hispanic man presents to the emergency department with loss of appetite and weakness. He also complain about constant pain in the upper abdomen that radiates to his back. He had not travelled in recent months and has not been well for several days. The patient appears jaundiced.								
Test			Laboratory results					Reference ranges			
Serum sample											
Sodium			134 mmol/L					136 - 145 mmol/L			
Potassium			5.2 mmol/L					3.5 – 5.1 mmol/L			
Chloride			100 mmol/L					98-107 mmol/L			
CO <sub>2</sub>			24mmol/L					23 -29 mmol/L			
Glucose (plasma/random)			10 mmol/l					3.9 -6.5 mmol/l			
Urea			8.2 mmol/L					2.1-7.1 mmol/l			
AST			275 mmol/L					5-30 IU/L			
LDH			395 IU/L					100-225 IU/L			
Calcium			1.6 mmol/L					2.2-2.7 mmol/L			
Serum Amylase			410 U/L					25-130 U/L			
Urine Amylase			85 U/h					1 – 15 U/h			
Lipase			4.8 U/ml					0-1.0 U/ml			

1.1 Supply a possible diagnosis. Give reasons for your answer and clinical significance of the results. (10)

1.2 Name one possible cause for this disease considering the jaundice: (1)

**[11]**

**TOTAL QUESTION 1 = 11**

**QUESTION 2**

Discuss in detail the Chemical Pathology laboratory findings for a patient diagnosed with Diabetic ketoacidosis. (18)

**TOTAL QUESTION 2 = 18**

**QUESTION 3**

A 65-year-old woman with a history of diabetes was seen by her physician for weight loss, anorexia, and general fatigue. As part of the physical examination, both “bronze” skin pigmentation (hyperpigmentation) and enlarged liver were noted. Her initial chemistry panel showed the following relevant results:

Albumin	3.7 g/dl	(3.8–5.0)
A LP	180 U/L	(30–135)
A LT	200 U/L	(10–60)
Total bilirubin	2.5 mg/dl	(0.2–1.2)
Serum iron	180 g/dl	(45–150)

Further testing for the elevated iron showed the following:

Serum iron	170 g/dl	(45–150)
Transferrin	210 mg/dl	(200–380)
Ferritin	300 g/L	
% Transferrin saturation	80%	

The patient was diagnosed with hemochromatosis that caused iron overload.

- 3.1 Explain why the serum ferritin concentration is increased in this condition? (1)
- 3.2 Are this patient’s conditions and symptoms typical of hemochromatosis? Explain why. (7)
- 3.3 What is a treatment plan for iron overload, and what is the main goal? (2)


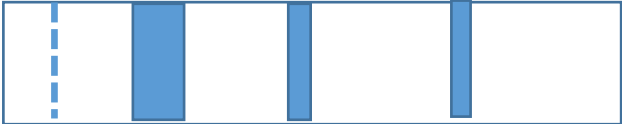
[10]

**TOTAL QUESTION 2 = 10**

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**QUESTION 4**

A 52-year old man, diagnosed with nephrotic syndrome consulted his doctor. In addition, of his diagnosis, the patient is overweight and lives an unhealthy lifestyle eating fatty foods on a daily basis. The urinalysis dipstick findings showed increased protein and his blood pressure was elevated. The following laboratory tests were urgently requested:

LABORATORY FINDINGS		
LIPOPROTEIN ELECTROPHORESIS		
<div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;"> <b>CM</b>   </div> <div style="text-align: center;"> <b>β</b>  </div> <div style="text-align: center;"> <b>pre-β</b>  </div> <div style="text-align: center;"> <b>α</b>  </div> <div style="text-align: right;"> <b>(Normal Control)</b> </div> </div>		
<div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;"> <b>CM</b>   </div> <div style="text-align: center;"> <b>β</b>  </div> <div style="text-align: center;"> <b>pre-β</b>  </div> <div style="text-align: center;"> <b>α</b>  </div> <div style="text-align: right;"> <b>(Patient result)</b> </div> </div>		
LIPID PROFILE/ U&E/GLUCOSE		
<b>Macroscopic appearance</b>	The serum appeared clear	
Test	Value	Reference ranges
<b>Na</b>	151 mmol/L	
<b>K</b>	4.5 mmol/L	
<b>Cl</b>	106 mmol/L	
<b>CO<sub>2</sub></b>	13 mmol/L	
<b>Urea</b>	10 mmol/L	
<b>Creatinine</b>	130 umol/L	
<b>Fasting plasma Glucose</b>	5.2 mmol/L	
<b>Total Cholesterol</b>	7.12 mmol/l	3.55 - 5.59 mmol/l
<b>HDL</b>	1.2 mmol/l	0.83 - 1.5 mmol/l
<b>LDL (Direct)</b>	5.2 mmol/l	1.92 - 3.83 mmol/l
<b>Triglyceride</b>	1.5 mmol/l	0.4 - 2.26 mmol/l

- 4.1 Name the calculation formula used to calculate Indirect LDL. (1)
- 4.2 Calculate the Indirect LDL using this equation. (2)
- 4.3 Is this calculation valid or invalid and why? (2)

- 4.4 Attempt a possible diagnosis and give reasons for your answer. (7)
- 4.5 What is the main cause of this condition? (2)
- 4.6 Discuss one lipid lowering drug that could be used in the treatment of this patient and the drugs action on the lipid profile. (5)

**TOTAL QUESTION 4 = 19**

**QUESTION 5**

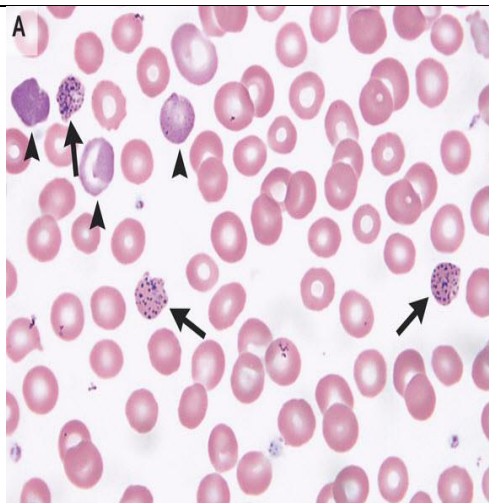
Match column A with column B. Only write down the number and corresponding answer. (10)

Column A	Column B
5.1 Partial Seizures	a. Indicated for anxiety disorders
5.2 Valproic acid	b. Decreases heart rate and output and reduce renin release.
5.3 Diazepam	c. Reduces peripheral arterial resistance
5.4 Nystatin	d. Brief episodes of blank staring
5.5 Atorvastatin	e. Indicated for Candida or thrush (oral Candida)
5.6 Beta blockers	f. Decreases lipoprotein lipase activity
5.7 ACE inhibitors	g. ACE inhibitor
5.8 Aspirin	h. Indicated for seizure types, particular combined seizures
5.9 Digoxin	i. Inhibits clot formation (platelet aggregation)
5.10 Vasodilator	j. Increases clot formation
	k. Consist of single dysfunction which does not change during an episode
	l. Prevents sympathetic outflow the liver
	m. Increases calcium influx into myocardial cells
	n. Inhibits VLDL synthesis

**TOTAL QUESTION 5 = 10**



**QUESTION 6**

Patient		Miss L. Kleyn		Age:		16	
Weight		N/A		Height		N/A	
Body surface area		N/A					
Clinical data		<p>A 16-year-old girl presented with severe abdominal pain, being diagnosed with acute appendicitis and she underwent appendectomy, but the pain persisted. Her main symptoms and signs were severe abdominal pain, vomiting, and arterial hypertension. For the last seven years, the girl was actively involved in the family's pottery business and lived a healthy lifestyle. On physical examination it was also noticed that she had a thin, black-blue line visible along the margin of the gums, at the base of the teeth. (Burtons line)</p> <p>The following laboratory tests were requested.</p>					
LABORATORY FINDINGS							
Chemical Pathology Test		Value				Reference ranges	
Na		132 mmol/L				136 - 145 mmol/l	
K		2.85 mmol/L					
ALT		158 U/L					
AST		63 U/L					
GGT		128 U/L					
Con Bilirubin		1.4 mg/dl					
delta-aminolevulinic acid (Urine)		7.66 mg/L				< 4.5mg/L	
Blood lead		66.28 ug/dL				> 10ug/dL	
Urine lead		419.7 ug/L				< 50ug/L	
Haematology Test		Value				Reference ranges	
Hb		10.9g/dL					
HCT		31.6 %					
Peripheral blood smear							
		Ultrasound					
Abdominal ultrasound		Disappearance of the delimitation between the cortical and medullar parts in both kidneys.					

- 6.1 Attempt a possible diagnosis and give reasons for your answer. (7)
- 6.2 Would the laboratory results for urea and creatinine be normal/low/high? (1)
- 6.3 What treatment would be recommended? (2)
- 6.4 The physician recommended neurological assessment. Why? (1)

[11]

**TOTAL QUESTION 6 = 11**

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**QUESTION 7**

A 50 year old- male patient was admitted to hospital with the following symptoms, swelling of the legs, difficulty breathing and a persistent cough and wheezing.

You have received two samples on this patient as indicated in the below table.

- 7.1 Calculate whether the pleural fluid is an Exudate or Transudate. Show all calculations and **comment** on your findings. (13)

Test	Serum	Pleural fluid
Total Protein	120 g/dl	5 g/dl (1:2 manual dilution)
LD/LDH	220U/L	16 U/L (1/3 manual dilution)
Albumin	23g/L	10g/L

- 7.2 Name two possible causes for the findings in 7.1. (2)

**TOTAL QUESTION 7 = 15**

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### **QUESTION 8**

Patient GD, a 75-year-old man, was admitted to the coronary care unit. Mr GD had been suffering from confusion for the past two weeks. He had been feeling nauseous and had been vomiting, and was not eating or drinking properly. He was not in pain or short of breath but felt dizzy and sleepy.

**Drug history** Mr GD was taking:

- a) Pravastatin 40mg
- b) Bisoprolol 7.5mg
- c) Warfarin (variable dose) for stroke prevention
- d) Digoxin 250µg

**Examination** On examination Mr GD was found to be in arterial fibrillation with a pulse rate of 35 to 50 beats per minute. His ECG showed widespread ST depression suggestive of digoxin toxicity.

Other laboratory results:

• Creatinine 170µmol/L	[normal range 53–97µmol/L]
• Urea 21mmol/L	[2.9–7mmol/L]
• Potassium 5.5mmol/L	[3.5–5 mmol/L]
• Electrolytes normal, including magnesium	
• HbA1c 7.9%	[4–5.9 %]
• Hb 13g/dL	[13–18g/dl]
• Normal lactate and arterial blood gases	
• INR 1.5	[2–3]
• Digoxin 7ng/ml	[0.8–2ng/ml]

8.1 Discuss the mechanism of action of drug a, c and d. (17)

8.2 What effect does drug (a) have on the lipid profile? (5)

**TOTAL QUESTION 8 = 22**

### **QUESTION 7**

Discuss in detail, four types of seizures and name one drug to be administered for each. (28)

**TOTAL QUESTION 7 = 28**

**TOTAL SECTION B = 144**

**GRAND TOTAL: 185**