UNIVERSITY OF JOHANNESBURG

PROGRAM : *BIOMEDICAL TECHNOLOGY*

MODULE : **Chemical Pathology II A**

CODE : **CPA2111**

DATE : 17 JULY 2019
SUPPLEMENTARY EXAMINATION

DURATION : 180 MINUTES

WEIGHT : 50: 50

TOTAL MARKS : 179

EXAMINER : W. KRUGER

MODERATOR : I. WAINER

NUMBER OF PAGES : 7 INCLUDING FRONT PAGE

INSTRUCTIONS : QUESTION PAPER MUST BE HANDED IN

REQUIREMENTS : 1 X EXAMINATION SCRIPT
: 1 X CALCULATOR

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 - INSTRUMENTATION AND TEST PRINCIPLES

1.1 Explain what method as well as the principle of each method, you would use in the analysis of each of the following:

1.1.1. Albumin and Haptoglobins in serum; (8)

1.1.2 CO_2 in blood; (4)

1.1.3. Urine osmolality. (5)

1.1.4 Separating components and measuring the distance travelled (11)

[28]

QUESTION 2 - INSTRUMENTATION AND TEST PRINCIPLES

Match the information in Column A with the information in Column B. Write down only the answer and corresponding number e.g. 2.1 Z (10)

Column A	Column B
2.1 Colorimeter	a) Translate photons to electrical signal
2.2 Migration of negative ions	b) Potassium/Sodium
2.3 β-globulins	c) Ag/AgCl reference
2.4 PM tube	d) Light intensity
2.5 Potential of hydrogen	e) Anode
2.6 Direct ISE	f) Turbidimetry
2.7 Intensity of the scattered light	g) Sample diluted
2.8 Chemiluminescence	h) Haptoglobin
2.9 End-point method	i) Low temperature
2.10 Ion selective electrode	j) Complement proteins
	k) Sample undiluted
	l) Nephelometry
	m) High temperature
	n) Substrate
	o) Enzyme
	p) Cathode

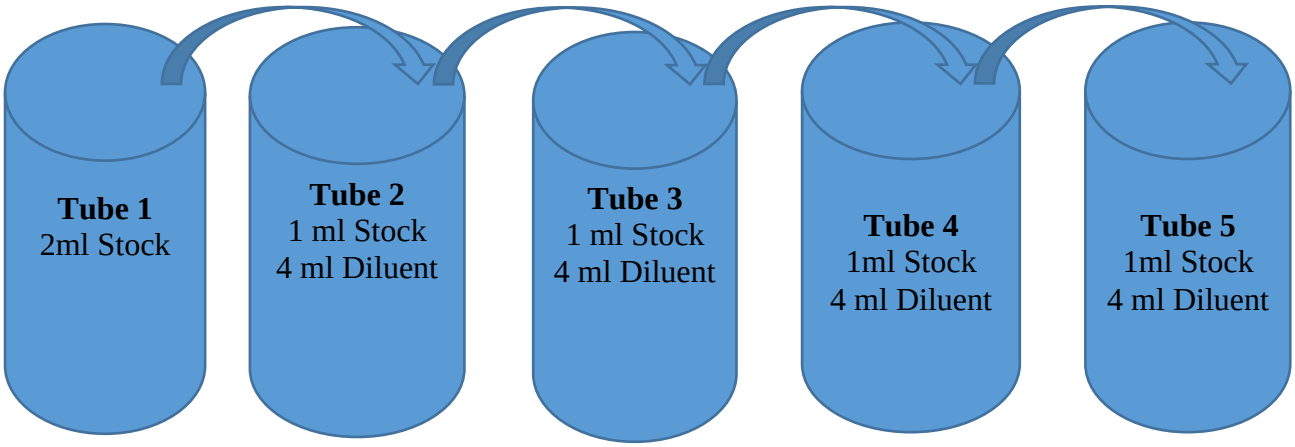
[10]

TOTAL SECTION A: 38

SECTION B

QUESTION 1- CALCULATIONS

1.1 You received a specimen for serology testing. The concentration for RPR is high and you are therefore required to make serial dilutions to obtain the final correct concentration. Your tubes are marked as follow:



Indicate the FINAL dilution factors calculated for tubes 2 to 5. (4)

1.2 Explain in FULL the difference between a 1 in 4 and 1to 4 dilution? (10)

1.3 You are required to prepare 100ml of 70% ethanol solution using 87% ethanol. Show all steps in your calculation. Round your answer off to one decimal. (3)

1.4 You received a CSF sample for processing in the microbiology laboratory. In order to perform a cell count on the sample, you need to dilute the sample. You take 5 drops of CSF sample and add 2 drops of crystal violet stain. What is your final dilution factor? Show all steps. (2)

1.5 You are required to prepare dilutions to draw up a standard curve for an assay. The stock is 20g/dl. You need to prepare 20ml of each standard. Complete the below table. **Show all calculation steps.** (9)

Final concentration of standard	Dilution factor	Volume of 20g/dl stock	Volume of Diluent
1 g/dl	1.5.1	1.5.2	1.5.3
5 g/dl	1.5.4	1.5.5	1.5.6
15 g/dl	1.5.7	1.5.8	1.5.9

1.6.1 Prepare a stock solution of 300ml of Normal Saline. Show all your calculations. (3)

1.6.2 What is the concentration in mmol/L for 1.4? Show all calculations. (4)
Na = 23 Cl= 35.5 NaCl = 58.5

1.5 Convert the following units of measure:

1.5.1 50umol/L= mmol/L (2)

1.5.2 90mg/L =? g/L (2)

1.5.3 6910umol/L = mmol/dl (2)

[41]

QUESTION 2 – QUALITY ASSURANCE

2.1 You are required to prepare fresh quality control material to validate sodium on your automated analyzer. You noticed that the old box of controls is finished and you have to open a new box of controls to prepare this material. Explain in detail the important information, which you need to check and document when opening a new box of controls and the information in the package insert. (7)

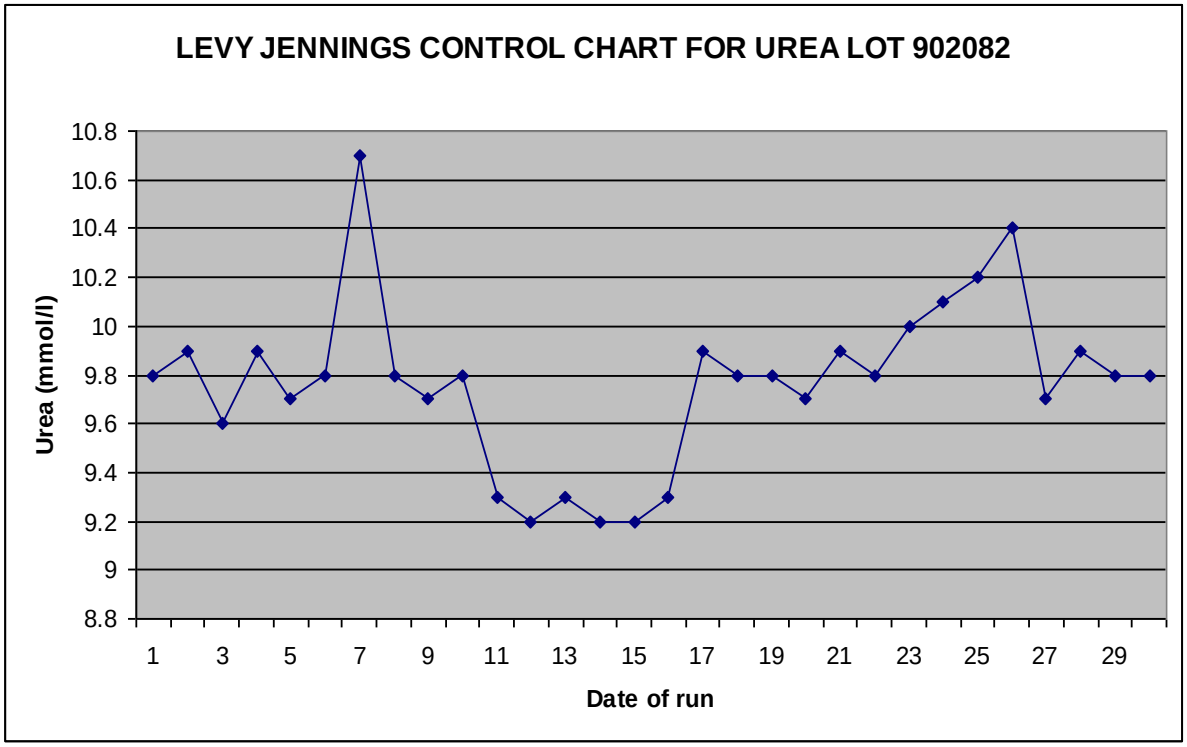
2.2 Discuss in detail three main factors involved in the pre-analytical quality assurance process in a diagnostic laboratory. For each factor/subject – list two examples. (9)

[16]

QUESTION 3 – QUALITY CONTROL

Comment on the below Levy-Jennings chart. Comment on Westgard violations, systematic and random errors and supply possible causes for each. Mean = 9.8 and 1 SD = 0.4
(22)

Month: Nov 2010 Expiry date: 03/12/2010 Level 1 control



[22]

QUESTION 4 - ACID BASE BALANCES

4.1. The body's first line of defense against extreme changes in hydrogen concentrations is the BUFFER SYSTEMS present in the all body fluids.

Explain in detail the Carbonic acid- bicarbonate buffering system. Include the chemical reaction that occurs. (13)

4.2 Complete the following table relating to acid base disturbances.

Write down the number and answer only e.g. 4.1.1 =Increased (16)

Acid base disorder	pH	PCO2	HCO3	BE (+ or – or normal)
Partially compensated Respiratory acidosis	**4.2.1**	**4.2.2**	**4.2.3**	**4.2.4**
Uncompensated Metabolic acidosis	**4.2.5**	**4.2.6**	**4.2.7**	**4.2.8**
Uncompensated Respiratory alkalosis	**4.2.9**	**4.2.10**	**4.2.11**	**4.2.12**
Fully compensated Metabolic alkalosis	**4.2.13**	**4.2.14**	**4.2.15**	**4.2.16**

4.3 List three possible causes for each:

4.3.1 Metabolic acidosis (3)

4.3.2 Metabolic alkalosis (3)

[35]

QUESTION 5 – KIDNEYS

Patient	Mr. Simons		**Age:**	38	
Weight	N/A	**Height**	N/A	**Body surface**	1.80
Clinical history	A 38-year old man presents to the emergency department with severe swelling (edema), particularly around the eyes, ankles and feet. His urine is foamy and he complaint about fatigue and loss of appetite. The patient was diagnosed previously with diabetes. The doctor ordered the following laboratory tests				
Test	**Laboratory results**	**Reference ranges**			
Serum/Urine					
Sodium	125 mmol/L	136 - 145 mmol/L			
Potassium	5.8 mmol/L	3.5 – 5.1 mmol/L			
Chloride	95 mmol/L	98-107 mmol/L			
HCO_3	12 mmol/L	21 – 28 mmol/L			
Glucose	10 mmol/L	3.9 -6.5 mmol/L			
Urea	12.5 mmol/L	2.1-7.1 mmol/L			
Serum Creatinine	1000 umol/L				
Urine Creatinine	2mmol/L				
Calcium	1.6 mmol/L	2.2-2.7 mmol/L			

5.1 A person who suffers from **Diabetes Mellitus** is at risk of a disease of the kidney. Answer the following questions:

5.1.1. Name the kidney condition associated with this case study. (1)

5.1.2 24 hour urine volume = 1.5L Patient surface area = 1.80
Urine creatinine = 2mmol/L Serum urea =12.5mmol/L
Serum creatinine = 1000umol/L
Plasma glucose = 6.3mmol/ Serum sodium = 120mmol/L

Calculate the uncorrected creatinine clearance for this patient. Show all calculations. (6)

5.1.3 Calculate the corrected creatinine clearance. Comment on your result. (3)

5.1.4 Supply the expected urine and serum osmolality results and give reasons for your answer. (5)

5.1.5 Calculate the anion gap and comment on your findings. Give a reason why the result is increased, normal or decreased. (6)

[21]

QUESTION 6 – ELECTROLYTES

A patient was admitted to the casualty unit and upon physical examination; the doctor confirms that the patient is severely dehydrated.

Describe two hormones and how each hormone will try to compensate in response to the condition. (9)

[9]

TOTAL SECTION B= 141

GRAND TOTAL: 179