NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH, APPLIED SCIENCES AND NATURAL RESOURCES

DEPARTMENT OF HEALTH SCIENCES

QUALIFICATION: BACHELOR OF MEDICAL LABORATORY SCIENCES	
QUALIFICATION CODE: 08BMLS	**LEVEL:** 6
COURSE CODE: CLC611S	**COURSE NAME:** CLINICAL CHEMISTRY 2A
SESSION: JULY 2022	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

SUPPLEMENTARY/SECOND OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER(S)	Dr Elzabe van der Colf
MODERATOR:	Dr Maurice Nyambuya

INSTRUCTIONS
1. Answer ALL the questions. 2. Write clearly and neatly. 3. Number the answers clearly.

PERMISSIBLE MATERIALS

1. Calculator
2. **Attachment** Levey-Jennings chart

THIS QUESTION PAPER CONSISTS OF 8 PAGES (Including this front page)

QUESTION 1 [10]

The following question relates to specimen collection and specimen handling. Fill in the missing words from the list provided – only write the question number and the missing word/s.

unlabelled	jaundice	well-organized
infectious	patient preparation	stressed
identity	confident	anaemia
name of the patient	K^+	LD

1.1 A phlebotomist should be _____ and _____.

1.2 He/she should make sure of the _____ of the patient before sample collection.

1.3 The phlebotomist should write the _____ on the tube AFTER collection.

1.4 A laboratory should never receive a sample which is _____.

1.5 Treat all specimens as if _____.

1.6 A haemolysed blood sample is unfit for analysis since the _____ and _____ would be raised.

1.7 Heel pricks are performed on newborn babies to test for blood bilirubin levels in the case of _____.

1.8 The laboratory is responsible to ensure correct _____ before sample collection, eg. fasting.

QUESTION 2 [12]

On Tuesdays the Clinical Chemistry Laboratory receives blood samples from patients who visit the Out-Patients Department (OPD) at the hospital. They are diabetics who come to have their blood glucose levels monitored.

9:00: You receive 20 blood samples for blood glucose testing. Each sample has a barcode and the patient's name written on the tube
9:15: You centrifuge the samples and load them into the automated analyser
10:00: You transfer the results from the analyzer to the LIS using the computerized system
10:15: Your supervisor signs off the results on the LIS
11:00: The doctor phones from OPD saying that he received a blood glucose result of 2 mmol/L for patient X. It means the patient should be hospitalized and treated immediately. He questions the result since the

patient was fine with the previous visit.

You will have to investigate and prove to the doctor that your result is correct.
Answer the following questions regarding this case scenario.

2.1 Identify possible errors in the **pre-analytical** phase of laboratory testing. **2**

2.2 Describe the patient preparation for a fasting blood glucose test. **1**

2.3 Identify possible errors in the **analytical** phase of laboratory testing. Outline what you would check, and possible causes of random and systematic errors. **5**

2.4 What information is stored in the analyzer which you could use as evidence that your result is correct? **2**

2.5 Identify possible errors in the **post-analytical** phase of laboratory testing. **2**

QUESTION 3 **[3]**

Identify three (3) safety hazards in a clinical chemistry laboratory.

QUESTION 4 **[12]**

When a patient suffers from liver cancer the alpha fetoprotein (AFP) level in the blood is raised. You tested a serum sample from a patient in the automated analyzer and the AFP level was out of the linear range of the instrument. A dilution needed to be made. You made a 1/10 dilution of the serum sample and re-run the test. The result was still out of the linear range of the instrument. Answer the following questions: 12

4.1 Which solution is commonly used in clinical chemistry as a diluent to make a dilution of serum. **1**

4.2 Explain the name given to the solution in 4.1. Referring to what? **1**

4.3 The percent concentration of physiological saline is 0.9%. Explain how you would prepare 100 ml of physiological saline. **3**

4.4 Mention which grade of water you would use for physiological saline and how it is prepared. **2**

4.5 Describe how you would make a 1/100 dilution of the serum. You have 2 ml serum available, and the analyzer requires 200 ul of diluted sample for analysis. Taking into consideration that pipetting of less than 10 ul

serum is not very accurate, you decide to use **10 ul of serum**. Calculate the total volume and the volume of diluent needed. **3**

4.6 The second dilution is re-run in the analyzer and the result is 10.58 IU/ml. Which result should be reported? Remember the unit of measurement. **2**

QUESTION 5 **[8]**

Match the definitions in column 1 with the correct terms in column 2. Each term should be used once. (One mark each.)

Column 1	Column 2
5.1 95% confidence limits	A.Mode
5.2 Substance treated exactly as a patient sample; used to detect analytical errors	B.Mean
5.3 Represents the smallest concentration that a test can measure	C.Diagnostic sensitivity
5.4 Comparison of a patient result with a previous result	D.Diagnostic specificity
5.5 Proportion of persons with a disease who test positive	E.Analytical sensitivity
5.6 The average value in a set	F.2SD
5.7 Proportion of persons without disease who test negative	G.Control
5.8 Most common value in a set	H.Delta check

QUESTION 6 **[15]**

The question relates to quality assurance. Consider the quality control done on the total protein test over a period of 10 days. The following values were obtained with the low protein control sample (Level 1).

Day	Low control total protein (g/l)
1	40
2	42
3	60

4	43
5	32
6	34
7	31
8	33
9	38
10	42

The manufacturer of the control material provided the following information for the low control:

Mean: 40 g/l
One standard deviation: 5 g/l

Answer the following questions.

6.1 Indicate the mean value which you will insert in the Levey-Jennings chart **1**

6.2 Calculate the value of one standard deviation above the mean. **1**

6.3 Calculate the value of two standard deviations above the mean. **1**

6.4 Calculate the value of one standard deviation below the mean. **1**

6.5 Calculate the value of two standard deviations below the mean. **1**

6.6 Use the information in your calculations above and plot the low control values for total protein over the ten days as indicated in the table above. Detach the provided graph paper and attach it to your answer sheet. **5**

6.7 Identify any day where there was an out-of-control incident and indicate which Westgard rule was violated. **2**

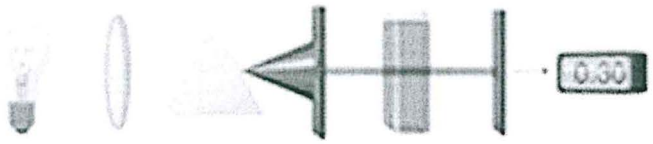
6.8 Was the error random or systematic? **1**

6.9 Identify one more violation of the Westgard rules. **1**

6.10 Describe possible corrective action for any of the errors above. **1**

QUESTION 7 **[5]**

List the names of the components in a spectrophotometer in correct order.



QUESTION 8 **[16]**

8.1 Discuss the relationship between absorbance, transmittance and concentration in a spectrophotometer. **6**

8.2 When given appropriate data, calculate an unknown concentration using Beer's Law. You have two test tubes. To the one you add a small volume of patient Y's serum. To the other tube you add the same volume of a standard. You add a volume of total protein reagent to both tubes. Mix well and incubate for 30 minutes at room temperature. You read the absorbance of each solution at 546 nm.
Results:
Absorbance patient Y serum: 0.422
Absorbance of standard: 0.533
Concentration of standard: 55.0 g/l total protein (given in package insert)

Calculate the concentration of total protein in patient Y's serum. **5**

8.3 Note that the Beer's Law is not obeyed at high concentrations. The Beer Lambert law is only valid up to a certain concentration. This determines the linearity of the method. Draw a diagram to illustrate what happens at a high concentration to the linearity between absorbance and concentration. **5**

QUESTION 9 **[11]**

9.1 Explain the basic principle of chemiluminescence **5**

9.2 State a common laboratory application for chemiluminescence. Used to detect which analytes? **2**

9.3 Discuss the advantages of using chemiluminescent techniques over other methods. **4**

QUESTION 10 **[8]**

Match each description in column 1 with the correct term in column 2.

Column 1 Description	**Column 2**
10.1.Commonly used chemiluminescent label	A.Blood gases
10.2. analytes which are measured with gas sensing ion selective electrodes	B. Antibody
10.3. analytes which are measured with ion selective electrodes	C. Affinity
10.4. a protein that combines with a specific antigen	D. Luminol
10.5. a substance capable of inducing the formation of an antibody; the substance which binds to an antibody in an immunoassay	E. Improvement of TAT
10.6. strength of the bond between an antigen and an antibody	F. Labels
10.7. attached to either an antigen or antibody, used to differentiate the patient analyte from reagent	G. Serum electrolytes
10.8.an advantage of automation in the clinical chemistry laboratory	H. Antigen

Attachment: Levey-Jennings chart

Name _____

Write the values of the mean and SD's in the right side and plot the control values.

Insert in your answer book