CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF

CHEM 351: FORENSIC CHEMISTRY

STREAMS:

TIME: 2 HOURS

DAY/DATE: WEDNESDAY 24/3/2021 **2.30 PM – 4.30 PM**

INSTRUCTIONS:

- Answer question ONE (Compulsory) and any other Two questions.
- Do not write on the paper.

QUESTION ONE (30 MARKS)

a) Define the following forensic terms (4 Marks)

i) Direct evidence

ii) Circumstantial evidence

iii) Chain of custody

iv) Destructive testing

b) A drug analysis is performed with gas chromatography/mass spectrometry (GC/MS) and requires the use of reliable standards. The lab purchases a 1.0 ml commercial standard that is certified to contain the drug of interest at a concentration of 1.00 mg/ml with a reported uncertainty of ±1.0 %. To prepare the stock solution for calibration, an analyst uses a syringe with an Uncertainty of ± 0.5 % to transfer 250.0 µL of commercials standard to a Class-A 250 ml volumetric flask with an uncertainty of ± 0.08 ml.

i) Calculate the final concentration in ppb (3Marks)

ii) Calculate the propagated uncertainty (2Marks)

iii) Indicate the final concentration and uncertainty (1 Mark)

c) Briefly explain the following terms (4Marks)

i) Method validation

ii) Standard Operating Procedure

d) Briefly discuss the analytical approach for analysis of Marijuana (5Marks)

e) Differentiate between Pharmacodynamics and Pharmacokinetics (2Marks)

i) Define the Bioavailability of a drug (1 Mark)

ii) The bioavailability of morphine is reported to be between 20% and 30%. A common pharmaceutical preparation of morphine is in the form of 40 mg tablets that contain 40 mg of the drug.

I) If a lady takes two pills at the same time, how much morphine will be in general circulation (3Marks)

II) Assume the lady weighs 145 lb and takes the tablets of morphine. Use V_d to estimate the peak plasma concentration. The range of V_d is 3-5 L/Kg (1 Kg= 2.3lb)

QUESTION 2 (20 MARKS)

a) Differentiate between the following terms (6Marks)

i) Accuracy and precision

ii) Random error and Systematic error

iii) Accreditation and Certification

b) A trainee in forensic chemistry laboratory is tasked with determining the concentration of cocaine in a white powder. The following data is obtained from a trainee 10 replicate analyses. The true value of mean is 13.2 ± 0.1%

Sample	**Value**
1	12.7
2	13.0
3	12.0
4	12.9
5	12.6
6	12.3
7	13.2
8	11.5
9	15.0
10	12.5

i) Calculate the mean (2Marks)

ii) Calculate the Standard(absolute) error (1 Mark)

iii) Calculate the Standard deviation of the sample (2 Marks)

iv) Calculate the variance (1 Mark)

c) Briefly explain the following terms (6 Marks)

i) Limit of detection (LOD)

ii) Limit of quantitation (LOQ)

iii) Robustness of a method

iv) Sensitivity

v) Uncertainty

d) Using a suitable example discuss the following drugs (2 Marks)

i) Depressants

ii) Narcotics

QUESTION THREE (20 MARKS)

a) As part of a method-validation study, three forensic chemists made ten replicate injections each in a GC/MS experiment and obtained data for area counts of a reference peak.

Injection No.	**A**	**B**	**C**
1	9995	10640	9814
2	10035	10118	10958
3	10968	10267	10285
4	10035	10873	10915
5	10376	10204	10219
6	10845	10593	10442
7	10044	10019	10752
8	9914	10372	10211
9	9948	10035	10676
10	10316	10959	10057

Assuming that the analyst technique is the only significant contributor to the spread of the data, which chemist had the most reproducible injection technique (5Marks)

b) Briefly Explain the following terms briefly (8Marks)
   i) Blank samples
   ii) Open controls or knowns
   iii) Calibration Checks
   iv) Replicates

c) Using a suitable examples give two classifications of drugs (4Marks)

d) Nicotine can be metabolized to cotinine and norcotinine. Describe each step in term of metabolic transformation transition involved (3Marks)

QUESTION 4 (20 MARKS)

a) Define the following terms (3Marks)
   i) Drug
   ii) Blinds or Blind control
   iii) Spikes

b) Briefly explain the following terms in relation to explosives (3Marks)
   i) Deflagration
   ii) Detonation

c) i) Explain the term Oxygen Balance and give its expression (3Marks)

   ii) Calculate the Oxygen Balance of nitroglycerin ($C_3H_5N_3O_9$) (3 Marks)

d) Using a relevant example give three classes of explosives for determination of safe shipping methods (3Marks)

e) Using the Springhill Roberts Rule predict the products of an explosion of nitroglycerin (5 Marks)

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