Forensic Chemistry

Content-level learning outcomes

QA/QC

General

1. Define in the context of forensic science and provide or identify examples of: forensic, identification, classification, individualization, characteristic, specific, false positive, false negative, direct evidence, circumstantial evidence, chain of custody, presumptive test, confirmatory test
2. Describe differences between a judicial approach and a scientific approach
3. Describe how courts decide whether or not to admit scientific testimony
4. List practices that can improve the quality of scientific data used as evidence
5. Explain why a given practice can improve the quality of scientific data
   Practices: blind testing, sequential testing, calibration checks, positive control, negative control, open control, blind control, aliquot, replicates, duplicates, spike
6. List some of the organizations that oversee QA/QC in forensic labs; Describe how they do so.
7. Describe some of the procedures in QA/QC of personnel and why these are important
8. Describe some of the practices in QA/QC of evidence handling and why these are important
9. Describe some of the practices in QA/QC of archiving and why these are important
10. List components of a standard operating procedure; explain why each component is important
11. Describe some of the practices in QA/QC of sample analysis and why these are important
12. Define: validation, systematic error, random error

Calibration

1. Define: calibration, signal, noise, control chart, calibration curve
2. Define: analyte, matrix, sample, standard, interference, blank
3. Describe an external standard calibration curve and how one is created
4. Inspect a calibration curve to evaluate for linearity and outliers
5. Explain why a calibration curve tends to flatten at extremes
6. Evaluate the quality of a calibration curve using figures of merit
7. Define the following figures of merit:
   Specificity, sensitivity, linearity, accuracy, precision, range, limit of quantitation, limit of linearity, detection limit, repeatibilty, reproducibility, ruggedness, uncertainty
8. Calculate the values (from a calibration curve) of:
   Sensitivity, precision, range, detection limit
9. Evaluate qualitatively (or describe how you can) from a calibration curve:
   Accuracy, limit of linearity, limit of quantitation
10. Define: standard addition, internal standard calibration, spike, internal standard
11. Explain why (under what circumstances) standard addition or an internal standard might be used

Sampling

1. Describe the importance/relevance of sampling techniques
2. List factors to consider in determining method of sampling
3. List factors to consider in determining how many samples to take
4. Describe one method to determine the number of samples to take

Standard Techniques

1. Describe light in terms of: particle model, wave model, energy, intensity
2. Describe different ways light interacts with matter: absorbance, emission, fluorescence, transmittance
3. Describe and/or identify a spectrum
4. Describe how a spectrum is used in forensic chemistry
5. Differentiate between atomic and molecular spectra
6. Describe how to use spectroscopic data in a calibration curve
7. Describe the general process of chromatography

8. Differentiate between liquid and gas chromatography
9. Evaluate whether gas or liquid chromatography is better for an analysis
10. Interpret a chromatogram for number of substances, properties of substances and quantity of substance
11. Define reverse-phase liquid chromatography
12. Describe mass spectrometry
13. Describe a mass spectrum
14. Interpret a mass spectrum by comparison to knowns
15. Describe the difference and uses for a total ion chromatogram versus single ion monitoring