EXPERIMENT 7

FLAME PHOTOMETRY

15 Advanced Multiple-Choice Questions

Instruction: Select the single best answer and circle the correct option.

1. Which statement most accurately relates the excitation source to the analytical signal measured?

A. A flame is used to measure atomic absorption, whereas a lamp is used to measure atomic emission.
B. A flame produces excitation followed by measurement of emitted radiation, whereas lamp-based excitation is associated with measuring absorbed radiation.
C. Both flame and lamp excitation require measurement of fluorescence only.
D. A lamp measures emission because it converts atoms directly into an atomic vapor.

2. An atom absorbs radiation corresponding to the transition from E1 to E2, then returns directly from E2 to E1. Which statement is correct?

A. The emitted radiation has a lower frequency than the absorbed radiation.
B. The emitted radiation is polychromatic because the excited state is unstable.
C. The emitted radiation is monochromatic and has the same wavelength as the absorbed radiation.
D. The emitted energy is greater than the energy difference between E2 and E1.

3. Which flame region provides the most suitable conditions for flame spectroscopic measurements?

A. The preheating zone, because complete atomization occurs before ignition.
B. The primary combustion zone, because its high concentration of ions guarantees thermal equilibrium.
C. The interconal region, because it reaches maximum temperature and contains a high concentration of free atoms.
D. The outer cone, because all atoms remain uncombined after secondary combustion.

4. Which sequence correctly represents the major processes occurring from sample introduction to signal recording?

A. Atomization -> nebulization -> molecular formation -> absorption -> filtration -> readout
B. Nebulization -> aerosol transport -> atomization -> excitation -> emission -> wavelength selection -> detection and amplification
C. Vaporization -> condensation -> ion recombination -> fluorescence -> direct readout
D. Excitation -> nebulization -> atomization -> absorption -> amplification -> wavelength selection

5. Why is the primary combustion zone generally unsuitable for flame spectroscopy?

A. It contains only stable molecular species and no free radicals.
B. It has the lowest temperature within the flame.
C. It contains high concentrations of ions and free radicals and lacks thermal equilibrium.
D. It prevents the sample solution from undergoing nebulization.

6. Which statement correctly distinguishes absorption filters from interference filters?

A. Absorption filters operate in UV, visible, and IR regions, whereas interference filters are restricted to the visible region.
B. Absorption filters provide narrower bands than interference filters because they contain dielectric layers.
C. Absorption filters commonly consist of colored glass and are mainly used in the visible region, whereas interference filters produce relatively narrow bands through optical interference.
D. Interference filters are less expensive and function by absorbing all wavelengths emitted by the analyte.

7. Which assignment of components to the three fundamental flame-photometer systems is correct?

A. Emission system: filter and optical lenses; selection system: burner; recording system: nebulizer
B. Emission system: fuel, oxidant, nebulizer, and burner; selection system: optical lenses and filters; recording system: detector, amplifier, and readout
C. Emission system: phototube; selection system: flame; recording system: fuel and oxidant
D. Emission system: amplifier; selection system: nebulizer; recording system: interference filter

8. Which element-wavelength-flame colour combination is incorrectly matched?

A. Sodium - 589 nm - yellow
B. Calcium - 622 nm - orange
C. Barium - 554 nm - lime green
D. Lithium - 766 nm - violet

9. According to the listed fuel-oxidant combinations, which mixture produces the highest flame-temperature range?

A. Natural gas-air
B. Hydrogen-oxygen
C. Acetylene-nitrous oxide
D. Acetylene-oxygen

10. Which statement correctly describes premixed and unpremixed flames?

A. In a premixed flame, the fuel and oxidant first mix within the flame and produce turbulent flow.
B. In an unpremixed flame, the fuel and oxidant are mixed before combustion and exhibit laminar flow.
C. In a premixed flame, the fuel and oxidant are mixed before combustion, commonly producing laminar flow.
D. Both flame types require oxygen as the only possible oxidant.

11. A sample produces a response above the linear region of its calibration curve. What is the most analytically appropriate action?

A. Extrapolate the calibration curve beyond its highest standard without modifying the sample.
B. Dilute the sample until its response lies within the linear calibration range, then apply the dilution factor.
C. Use the calibration curve of another element with a similar wavelength.
D. Increase the flame temperature until the displayed concentration decreases.

12. During ORS preparation, 5.00 mL of the initially prepared solution is diluted to 100.0 mL. Which statement is correct?

A. The dilution factor is 5, and the original concentration equals five times the measured concentration.
B. The dilution factor is 20, and the original concentration equals twenty times the measured concentration.
C. The dilution factor is 25, and the measured concentration equals twenty-five times the original concentration.
D. The dilution factor is 100, and no correction is required for the measured result.

13. Which preparation produces an 80 ppm standard from a 200 ppm stock solution?

A. Diluting 25 mL of stock solution to 50 mL
B. Diluting 10 mL of stock solution to 25 mL
C. Diluting 10 mL of stock solution to 50 mL
D. Diluting 25 mL of a 40 ppm standard to 50 mL

14. What mass of NaCl is required to prepare 250 mL of a solution containing 200 ppm of sodium? Given: M(Na) = 22.990 g/mol and M(NaCl) = 58.44 g/mol.

A. 50.0 mg
B. 73.2 mg
C. 127.1 mg
D. 200.0 mg

15. A diluted ORS sample gives a potassium concentration of 38.0 mg/L. The sample dilution factor is 20, and the theoretical potassium concentration in ORS is 20 mmol/L.
Given: M(K) = 39.0983 g/mol. What is the approximate potassium percentage assay?

A. 48.6%
B. 76.0%
C. 97.2%
D. 102.9%

MODEL ANSWER KEY

Experiment 7 - Flame Photometry

Q	Ans.	Q	Ans.	Q	Ans.	Q	Ans.	Q	Ans.
1	**B**	2	**C**	3	**C**	4	**B**	5	**C**
6	**C**	7	**B**	8	**D**	9	**D**	10	**C**
11	**B**	12	**B**	13	**B**	14	**C**	15	**C**

Calculation checks

- Question 14: 200 mg Na/L x 0.250 L = 50.0 mg Na; mass of NaCl = 50.0 x (58.44/22.990) = 127.1 mg.
- Question 15: Actual K = 38.0 x 20 = 760 mg/L; theoretical K = 20 mmol/L x 39.0983 mg/mmol = 782.0 mg/L; assay = (760/782.0) x 100 = 97.2%.