

Flame Photometry

15 Very Difficult Multiple-Choice Questions

Source: IA (-5-) Flame Photometry

Format: Choose the best answer

1. Which sequence correctly represents the transformation of a metal salt solution during flame photometric analysis?

- A. Solution → gaseous salt → solid aerosol → free atoms → excited atoms
- B. Solution → solid aerosol → gaseous salt → free atoms → excited atoms
- C. Solution → free atoms → solid aerosol → gaseous salt → excited atoms
- D. Solution → excited atoms → gaseous salt → free atoms → ground-state atoms

2. The relatively high selectivity of flame photometry for alkali metals is primarily related to the fact that these elements:

- A. Require very high excitation energies and resist ionization
- B. Are easily excited by the relatively low energy supplied by the flame
- C. Absorb radiation more efficiently than they emit it
- D. Exist predominantly as ions rather than atoms in the flame

3. Which change would most likely increase emission intensity while simultaneously increasing the possibility of ionization interference for sodium?

- A. Decreasing flame temperature
- B. Changing from an organic solvent to water
- C. Increasing flame temperature substantially
- D. Decreasing the rate of sample introduction

4. According to the Boltzmann relationship, which condition would produce the greatest fraction of atoms in the excited state, assuming the excitation energy remains constant?

- A. A lower temperature because ground-state atoms become more stable
- B. A higher temperature because N_1/N_0 increases
- C. A lower temperature because $e^{(-\Delta E/kT)}$ increases
- D. Temperature has no influence on the excited-to-ground-state ratio

5. A calibration curve is prepared using aqueous standards, whereas the unknown sample is dissolved in an organic solvent. What is the most important expected consequence?

- A. The organic solvent may increase the rate of the process and emission intensity, producing a systematic error
- B. The aqueous standards will always have a higher emission intensity
- C. Solvent identity has no effect if the analyte concentration is identical
- D. Organic solvents completely prevent atomization of the analyte

6. Why should a very high-temperature flame generally be avoided when determining Na, K, or Li?

- A. These elements cannot be atomized at high temperature
- B. Their atoms undergo excessive molecular association
- C. They are easily ionized, reducing the population of neutral atoms available for emission
- D. High temperature prevents evaporation of their solvents

7. Which statement most accurately distinguishes the pre-mix burner from the total consumption burner?

- A. The pre-mix burner is free from explosion hazards, whereas the total consumption burner is not
- B. The total consumption burner mixes sample, fuel, and oxidant before they enter the burner
- C. The pre-mix burner provides a homogeneous flame but suffers from explosion hazards
- D. The total consumption burner prevents changes in aspiration rate caused by different solvents

8. In a total consumption burner, the sample, fuel, and oxidant:

- A. Are mixed in a chamber before entering the burner
- B. Pass through three concentric tubes and mix only at the burner tip
- C. Are converted into a homogeneous aerosol before entering the flame
- D. Are mixed by baffles before combustion

9. Which combination is correctly matched according to the flame-temperature data presented in the chapter?

- A. Propane-air -> 3100°C
- B. Hydrogen-oxygen -> 1725°C
- C. Acetylene-oxygen -> 3100°C
- D. Acetylene-air -> 1577°C

10. During the determination of calcium in serum, EDTA solution is used primarily to:

- A. Increase calcium ionization in the flame
- B. Prevent phosphate from interfering with calcium determination
- C. Convert calcium into a more volatile phosphate salt
- D. Increase the concentration of calcium before aspiration

11. Which statement concerning a heated graphite furnace, as presented in the material, is correct?

- A. It is less sensitive than flame atomization but gives superior precision
- B. It requires large liquid samples and cannot analyze solids
- C. It may be approximately 1000-fold more sensitive than flame atomization but can suffer from greater ionic interference
- D. It eliminates ionic interference because of its very high operating temperature

12. When selecting an analytical wavelength in flame photometry, the optimum wavelength should ideally provide:

- A. Minimum sensitivity and maximum spectral interference
- B. Maximum sensitivity and minimum spectral interference
- C. Maximum flame temperature regardless of spectral interference
- D. Maximum absorption by the solvent rather than the analyte

13. Which of the following best explains why very dilute solutions should preferably be prepared immediately before flame photometric measurement?

- A. Dilution increases flame temperature continuously with time
- B. Very dilute solutions may be unstable during storage
- C. The monochromator cannot detect freshly prepared solutions
- D. Dilute solutions rapidly convert all analyte atoms into ions

14. A calibration plot of emission intensity versus concentration shows a curved response at higher analyte concentrations instead of continuing linearly. Which statement is most consistent with the chapter?

- A. Such behavior is impossible because emission intensity is always perfectly proportional to concentration
- B. Deviations from linearity may occur in standard curves
- C. The presence of curvature proves that the detector is completely nonfunctional
- D. The concentration must necessarily be zero whenever linearity is lost

15. Which statement best integrates qualitative and quantitative uses of flame photometry?

- A. Qualitative analysis depends mainly on radiation intensity, whereas quantitative analysis depends only on flame color
- B. Qualitative identification may use a filter or monochromator, whereas quantitative analysis relates measured emission intensity to concentration using calibration or standard addition
- C. Both qualitative and quantitative analyses require atomic absorption rather than atomic emission
- D. Quantitative analysis can be performed without measuring emitted radiation intensity

Answer Key

Model answers for all 15 questions

Question	Correct Answer
1	B
2	B
3	C
4	B
5	A
6	C
7	C
8	B
9	C
10	B
11	C
12	B
13	B
14	B
15	B

End of questions