and titrate with 0.1 N per chloric acid VS to a blue endpoint. Perform a blank determination, and make any necessar y correction. Each mL of 0.1 N per chloric acid is equivalent to 31.15 mg of $C_{21}H_{29}NO$.

Biperiden Hydrochloride

$C_{21}H_{29}NO \cdot HCl$ 347.92

1-Piperidinepropanol, α-bicyclo[2.2.1]hept-5-en-2-yl-α-phenyl-, hydrochloride.

α-5-Norbornen-2-yl-α-phenyl-1-piperidinepropanol hydrochloride [1235-82-1].

» Biperiden Hydrochloride contains not less than 98.0 percent and not more than 101.0 per cent of $C_{21}H_{29}NO \cdot HCl$, calculated on the dried basis.

Packaging and storage—Preserve in well-closed, light-resistant containers.

USP Reference standards ⟨11⟩**—**
USP Biperiden Hydrochloride RS

Identification—

A: *Infrared Absorption* ⟨197K⟩.

B: *Ultraviolet Absorption* ⟨197U⟩—

Solution: 1 mg per mL.

Medium: methanol.

Absorptivities at 257 nm, calculated on the dried basis, do not differ by more than 3.0%.

C: Dissolve about 20 mg in 5 mL of phosphoric acid: a green color is produced.

D: To 5 mL of a solution (1 in 500) add bromine TS dropwise: a yellow precipitate, which dissolves on shaking, is formed. Addition of more bromine TS produces a precipitate that does not dissolve on shaking.

E: A 5-mL portion of a solution (1 in 500) responds to the tests for *Chloride* ⟨191⟩.

Loss on drying ⟨731⟩**—**Dry it at 105 ° for 3 hours: it loses not more than 0.5% of its weight.

Ordinary impurities ⟨466⟩**—**

Test solution: methanol.

Standard solution: methanol.

Eluant: a mixture of methanol and ammonium hydroxide (100:1.5).

Visualization: 17.

Assay—Accurately weigh about 500 mg of Biperiden Hydrochloride, and dissolve in 80 mL of glacial acetic acid, warming slightly, if necessary, to effect solution. Cool, add 1 drop of crystal violet TS and 10 mL of mer curic acetate TS, and titrate with 0.1 N per chloric acid VS to a blue endpoint. Per form a blank determination, and make any necessar y correction. Each mL of 0.1 N per chloric acid is equivalent to 34.79 mg of $C_{21}H_{29}NO \cdot HCl$.

Biperiden Hydrochloride Tablets

DEFINITION

Biperiden Hydrochloride Tablets contain NLT 93.0% and NMT 107.0% of the labeled amount of $C_{21}H_{29}NO \cdot HCl$.

IDENTIFICATION

• **Thin-Layer Chromatographic Identification Test** ⟨201⟩

Standard solution: Dissolve 10 mg of USP Biperiden Hydrochloride RS in 5 mL of water, mix, and sonicate to disperse the powder. Add 5 mL of methanol to the flask, mix, and sonicate for 15 min. Filter the solution into a separator, add 2 mL of 1 N sodium hydroxide and 10 mL of chloroform, and shake for 3 min. Filter the chloroform layer into a stoppered flask, and use the chloroform filtrate.

Sample solution: To a quantity of finely powdered T ablets, equivalent to 10 mg of biperiden hydrochloride, add 5 mL of water, mix, and sonicate to disperse the powder. Add 5 mL of methanol to the flask, mix, and sonicate for 15 min. Filter the solution into a separator, add 2 mL of 1 N sodium hydroxide and 10 mL of chloroform, and shake for 3 min. Filter the chloroform layer into a stoppered flask, and use the chloroform filtrate.

Adsorbent: 0.25-mm layer of chromatographic silica gel mixture. Condition by heating the plate at 105 ° for 1 h and allowing to cool.

Application volume: 20 µL

Developing solvent system: Methanol and ammonium hydroxide (100:1.5)

Visualization: Iodine vapor, 10 min

Analysis: Separately apply the *Sample solution* and the *Standard solution* to the chromatographic plate. Allow the applications to dr y, and develop the chromatogram in the *Developing solvent system* until the solvent front has moved about three-fourths of the length of the plate. Remove the plate from the chamber, mark the solvent front, and allow the solvent to evaporate. Locate the spots on the plate by exposing the plate for 10 min to iodine vapors in a preequilibrated closed chamber, on the bottom of which there are iodine cr ystals.

Acceptance criteria: The R_F value of the principal spot of the *Sample solution* corresponds to that of the *Standard solution.*

ASSAY

• **Procedure**

Solution A: 38 g/L of monobasic sodium phosphate and 2 g/L of anhydrous dibasic sodium phosphate in water. Adjust to a pH of 5.3 ± 0.1, if necessar y.

Solution B: Dissolve 400 mg of bromocresol purple in 30 mL of water, add 6.3 mL of 0.1 N sodium hydroxide, and dilute with water to 500 mL.

Phosphate buffer–bromocresol purple solution: Mix equal volumes of *Solution A, Solution B*, and chloroform, shake in a separator, and discard the chloroform. If appreciable color is extracted, repeat with additional portions of chloroform until no color is extracted.

Standard stock solution: 0.8 mg/mL of USP Biperiden Hydrochloride RS in methanol

Standard solution: 40 µg/mL of USP Biperiden Hydrochloride RS, prepared as follows: T ransfer a suitable volume of *Standard stock solution* to a suitable volumetric flask, add 25% of the flask volume of water, and dilute with methanol to volume.

Sample solution: Nominal concentration of 40 µg/mL of biperiden hydrochloride from NL T 20 Tablets, prepared as follows: Transfer a portion of finely powdered T ablets, to obtain the final nominal concentration, to a suitable volumetric flask; add 25% of the volume of water; and heat on a steam bath for 15 min. Cool, and dilute with methanol to volume.

Blank: Methanol and water (3:1)

Analysis

Samples: *Standard solution, Sample solution*, and *Blank*

Transfer 5.0 mL each of the *Standard solution*, the *Sample solution*, and the *Blank* to individual separators, each containing 10.0 mL of *Phosphate buffer–bromocresol purple solution*. Extract the solution in each separator with 20.0 mL of chloroform for 2 min. After the layers have separated, pass each chloroform extract through filter paper (Whatman No. 31 or equivalent) into separate glass-stoppered, 50-mL volumetric flasks. In the same manner, extract the solution in each separator with another 20.0-mL portion of chloroform, filter, and wash each filter with 8 mL of chloroform, collecting each combined filtrate and washing, respectively, in the 50-mL volumetric flask containing the first extract. Dilute each with chloroform to volume. Concomitantly determine the absorbances of the

solutions in 1-cm cells at the wavelength of maximum absorbance at about 408 nm, with a suitable spectrophotometer, using the *Blank* to set the instrument.

Calculate the percentage of the label claim of $C_{21}H_{29}NO \cdot HCl$ in the Tablets taken:

$$\text{Result} = (A_U/A_S) \times (C_S/C_U) \times 100$$

A_U = absorbance of the *Sample solution*
A_S = absorbance of the *Standard solution*
C_S = concentration of USP Biperiden Hydrochloride RS in the *Standard solution* (µg/mL)
C_U = nominal concentration of the *Sample solution* (µg/mL)

Acceptance criteria: 93.0%–107.0%

PERFORMANCE TESTS

- **DISSOLUTION ⟨711⟩**

Medium: 0.01 N hydrochloric acid; 500 mL
Apparatus 2: 50 rpm
Time: 45 min

[NOTE—Determine the amount of $C_{21}H_{29}NO \cdot HCl$ dissolved by using the following method.]

Phosphate buffer–bromocresol purple solution: Prepare as directed in the *Assay*.
Standard stock solution: 0.8 mg/mL of USP Biperiden Hydrochloride RS in methanol
Standard solution: 2 µg/mL of USP Biperiden Hydrochloride RS, prepared as follows: Pipet 5 mL of *Standard stock solution* into a 500-mL volumetric flask, and add 0.01 N hydrochloric acid to volume. Pipet 25 mL of this solution into a suitable beaker, and adjust with 0.01 N sodium hydroxide to a pH of 5.3. Transfer this solution to a 100-mL volumetric flask with the aid of water, and dilute with water to volume.
Sample solution: Sample per *Dissolution* ⟨711⟩. Filter 75 mL of the solution under test, pipet 50 mL of the clear filtrate into a suitable beaker, and adjust with 0.01 N sodium hydroxide to a pH of 5.3. Transfer this solution to a 100-mL volumetric flask with the aid of water, and dilute with water to volume.
Blank: Water
Analysis
Samples: *Standard solution, Sample solution*, and *Blank*
Pipet 20.0 mL each of the *Standard solution*, the *Sample solution*, and the *Blank* into individual separators, each containing 10.0 mL of *Phosphate buffer–bromocresol purple solution*. Extract the solution in each separator with 40.0 mL of chloroform for 10 min. After the layers have separated, pass each chloroform extract through filter paper into separate, glass-stoppered containers, discarding the first 10 mL of each filtrate. Determine the amount of $C_{21}H_{29}NO \cdot HCl$ dissolved from absorbances at the wavelength of maximum absorbance at about 408 nm (10-cm cells) of the extract from the *Sample solution* in comparison with that of the extract from the *Standard solution*, using the *Blank* to set the instrument.
Tolerances: NLT 75% (Q) of $C_{21}H_{29}NO \cdot HCl$ is dissolved.

- **UNIFORMITY OF DOSAGE UNITS ⟨905⟩:** Meet the requirements

ADDITIONAL REQUIREMENTS

- **PACKAGING AND STORAGE:** Preserve in tight containers.
- **USP REFERENCE STANDARDS ⟨11⟩**

USP Biperiden Hydrochloride RS

Biperiden Lactate Injection

$C_{21}H_{29}NO \cdot C_3H_6O_3$ 401.54
1-Piperidinepropanol, α-bicyclo[2.2.1]hept-5-en-2-yl-α-phenyl-, compd. with 2-hydroxypropanoic acid (1:1).
α-5-Norbornen-2-yl-α-phenyl-1-piperidinepropanol lactate (salt) [7085-45-2].

» Biperiden Lactate Injection is a sterile solution of biperiden lactate ($C_{21}H_{29}NO \cdot C_3H_6O_3$) in Water for Injection, prepared from Biperiden with the aid of Lactic Acid. It contains not less than 95.0 percent and not more than 105.0 per cent of the labeled amount of $C_{21}H_{29}NO \cdot C_3H_6O_3$.

Packaging and storage—Preserve in single-dose containers, preferably of Type I glass, protected from light.

USP Reference standards ⟨11⟩—
USP Biperiden RS
USP Endotoxin RS

Identification—Using a volume of Injection, equivalent to about 50 mg of biperiden lactate, and using a solution of 50 mg of USP Biperiden RS in 25 mL of 0.01 N hydrochloric acid, proceed as directed under *Identification—Organic Nitrogenous Bases* ⟨181⟩, beginning with "Transfer the liquid to a separator": the Injection meets the requirements of the test.

Bacterial endotoxins ⟨85⟩—It contains not more than 83.3 USP Endotoxin Units per mg of biperiden lactate.

pH ⟨791⟩: between 4.8 and 5.8.

Other requirements—It meets the requirements under *Injections* ⟨1⟩.

Assay—

Phosphate buffer–bromocresol purple solution—Prepare as directed in the *Assay* under *Biperiden Hydrochloride Tablets.*

Standard preparation—Transfer about 80 mg of USP Biperiden RS, accurately weighed, to a 100-mL volumetric flask, add methanol to volume, and mix. Transfer 5.0 mL of this solution to a second 100-mL volumetric flask, add 25 mL of water, dilute with methanol to volume, and mix to obtain a *Standard preparation* having a known concentration of about 40 µg per mL.

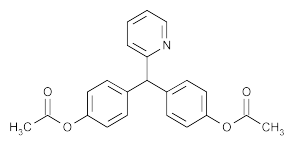
Assay preparation—Transfer an accurately measured volume of Injection, equivalent to about 5 mg of biperiden lactate, to a 100-mL volumetric flask, add 25 mL of water, dilute with methanol to volume, and mix.

Procedure—Proceed as directed in the *Assay* under *Biperiden Hydrochloride Tablets.* Calculate the quantity, in mg, of $C_{21}H_{29}NO \cdot C_3H_6O_3$ in each mL of the Injection taken by the formula:

$$(401.55 / 311.47)(0.1C / V)(A_U / A_S)$$

in which 401.55 and 311.47 are the molecular weights of biperiden lactate and biperiden, respectively; C is the concentration, in µg per mL, of USP Biperiden RS in the *Standard preparation; V* is the volume, in mL, of Injection taken; and A_U and A_S are the absorbances of the solutions from the *Assay preparation* and the *Standard preparation*, respectively.

Bisacodyl



$C_{22}H_{19}NO_4$ 361.39
Phenol, 4,4′-(2-pyridinylmethylene)bis-, diacetate (ester).
4,4′-(2-Pyridylmethylene)diphenol diacetate (ester) [603-50-9].

» Bisacodyl contains not less than 98.0 per cent and not more than 101.0 per cent of $C_{22}H_{19}NO_4$, calculated on the dried basis.