HM-POL
polarizing microscope

Leitz WETZLAR

Instructions

550 - 33 / Engl.

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Instructions

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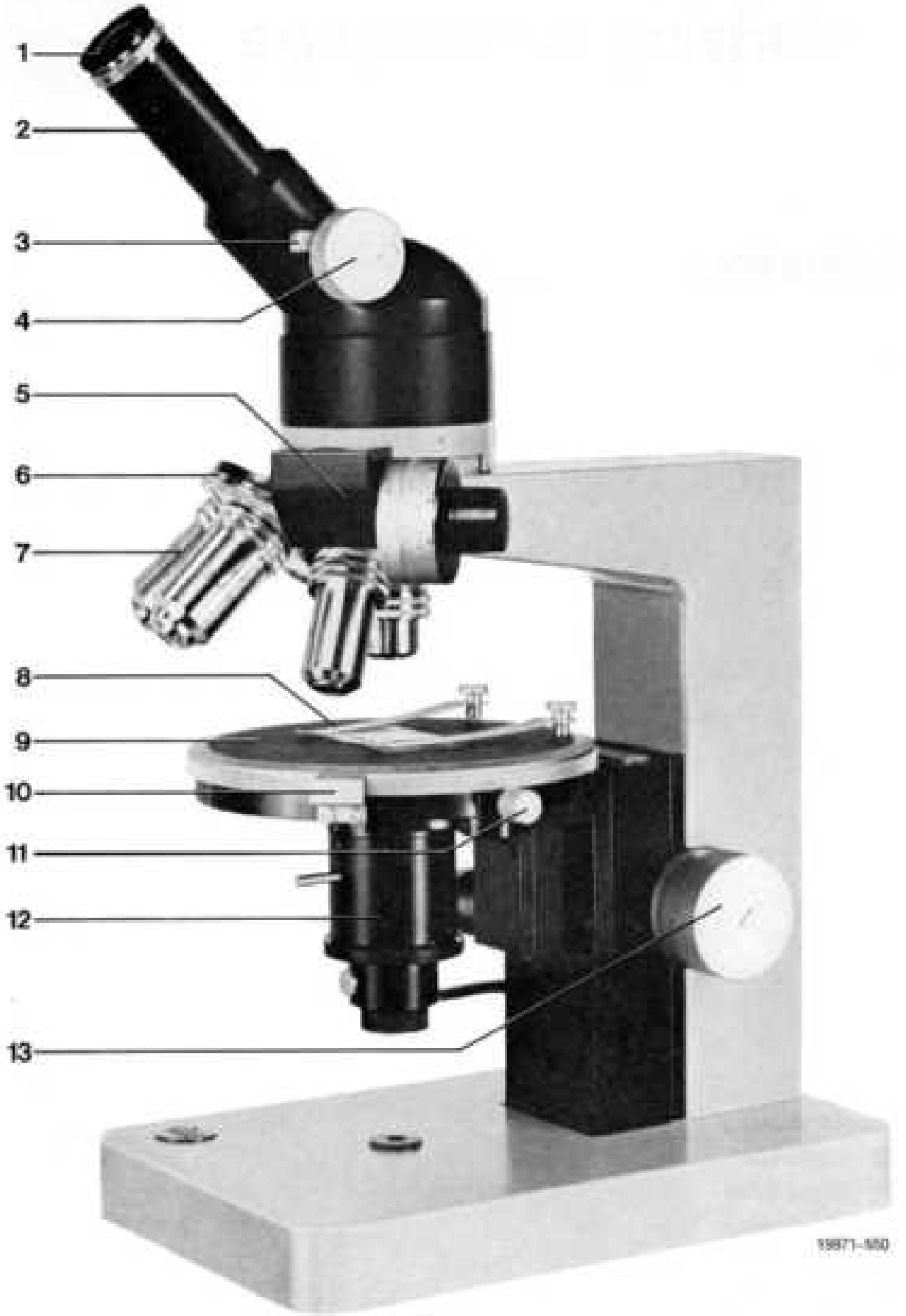
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1 Introduction

The LEITZ HM-POL polarizing microscope is a students and teaching microscope with which the most important investigations in polarized light can be carried out in parallel and convergent light. The combination of light source, condenser, and polarizer permits considerably simplified operation. The following structural features are characteristic of the microscope:

Built in 5W ellipsoid illuminator, with polarizor rotatable through 90°.

Single knob coarse and fine focusing, actuating the object stage, which runs on ball bearings.

Quintuple objective centring revolving nosepiece.

Permanently built in monocular tube with Bertrand lens and pin hole stop.

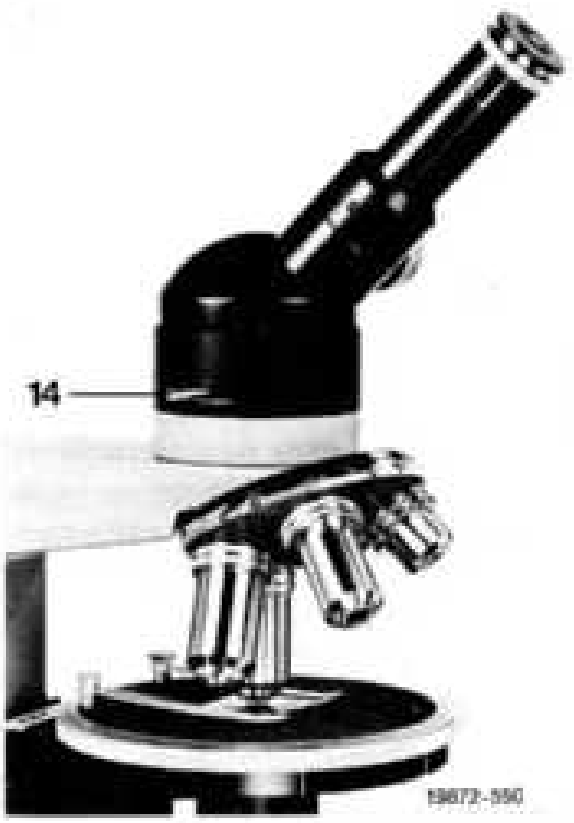

Fig. 1
LEITZ HM-POL polarizing microscope
1 eyepiece
2 monocular tube
3 pinhole stop
4 Bertrand lens
5 tilting compensator
6 objective centring nosepiece
7 objective
8 stage clip
9 object stage
10 verniers
11 arresting screw
12 ellipsoid illuminator
13 single-knob adjustment

Fig. 2
Monocular tube on the HM-POL
14 analyser

2 Operation

21 Illumination

Connect the transformer.
Ensure that the voltage set on the transformer agrees with your mains voltage. Technical details will be found in the instructions enclosed with the transformer (List 514-91, p.4).
Normally, the 5W ellipsoid illuminator is supplied already centred. Should, however, centring of the light source become necessary (e.g. after lamp replacement) proceed as follows:
Release knurled screw (3.18) and vertically adjust the lamp mount (3.19) so that the most concentrated light patch is formed on the opal disc.
Retighten the knurled screw.
Release the knurled ring (3.17) by rotating it and adjust the lamp mount until the light patch is in the centre of the opal disc.
Retighten knurled ring.
Again vertically adjust the lamp mount until the opal disc is uniformly illuminated. 6v 5W replacement lamp Code No. 500073.
With this setting all objectives can be used. If the condenser aperture is to be reduced to increase image contrast or to measure phase differences, the illuminator must be lowered with knob (3.15).
The lever (3.16) serves for the rotation of the polarizer so that it is possible to work both with crossed and with parallel polarizers.

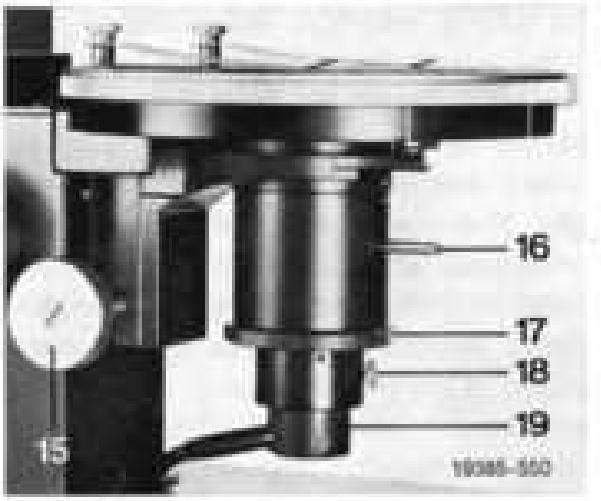

Fig. 3
Ellipsoid illuminator
15 drive knob
16 polarizer
17 knurled ring
18 knurled screw
19 lamp mount

22 Orthoscopy

Orthoscopy is the normal observation of the object.
Turn the objective of desired magnification into the optical path. Place the specimen on the object stage and immobilize it with the stage clips (1.8). For higher magnifications the use of an attachable mechanical stage is recommended.
Focus the specimen by means of the coarse and fine adjustment (1.13).

Centring the objective

a) Move a prominent part of the specimen into the centre of the crosslines M.
b) Rotate the object stage until the area of the object is furthest away from the centre M of crosslines. Position A. (In extreme cases the point A (maximum deviation of the object area) can be situated even outside the field of view).

Fig. 4
Centring of the individual objectives with the aid of the centring keys

c) Insert both centring keys (Fig. 4) in the apertures above the objective used. Move the microscopic image by turning the centring keys so that the object area is precisely in the middle (position B) of the line connecting the crosslines M and the maximum deviation position A.

d) Move the specimen manually or with the aid of the attachable mechanical stage until the prominent area is in the centre of the crosslines (M).

Rotate the object stage and check whether the rotating axis of the stage coincides with the centre of the crosslines in the eyepiece. If exact coincidence has not yet been achieved, repeat the centring procedure.

Crossing polarizer and analyser

Set an empty area in the specimen or remove the specimen from the optical path.
Set the lamp at maximum brightness.
Move the illuminator to its topmost position (3.15).
Turn lever (3.16) to the front.
Swing in the analyser (2.14).
Turn in the Bertrand lens (1.4).
Adjust lever (3.16) so that maximum darkness is obtained in the eyepiece. (If higher power objectives are used a symmetrical, dark, blurred cross will be recognised with correct focusing.)
Turn out the Bertrand lens.
The microscope is now ready for orthoscopic illumination.

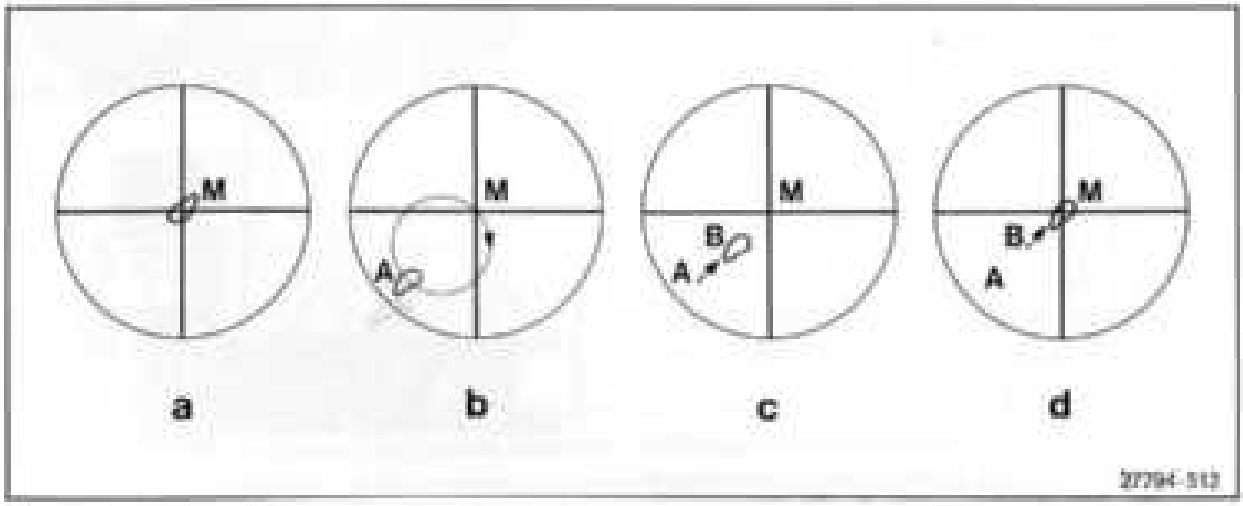

Fig. 5 Centring an objective

Orientation of the specimen

For most investigations in polarized light anisotropic objects must be rotated through 45° from their extinction position. For this purpose the angle value of the stage is read off the verniers (1.10) and the new position of the stage (diagonal position) found by addition or subtraction of 45°.

The rotation through 45° can be carried out without any calculations as follows, unless above-average accuracy of the 45° angle is required:

If, for instance, a rotation through 45° to the left is required, the left thumb nail is inserted in the knurl above the white index line on the front of the stage and the stage rotated until the nail faces the indicator mark of the vernier on the left. Proceed analogously for rotation to the right.

Measurement of phase differences

The following compensators can be used for the measurement of phase differences:

1) Tilting compensator M up to IV orders.
2) Tilting compensator K up to X orders.
3) Tilting compensator K up to XXX orders.
4) Rotating compensator according to Brace-Köhler, either with λ/10-, λ/20-, or λ/30-plates.

The use of the compensators is described in the operating instructions enclosed with them.

Use of the quartz wedge, λ- and λ/4-slide

These compensators serve for the determination of the vibration directions γ' and α' as well as the character of birefringence. The compensators (1.5) are inserted in the tube slot.

Fig. 6 Tilting compensator M on the HM-POL

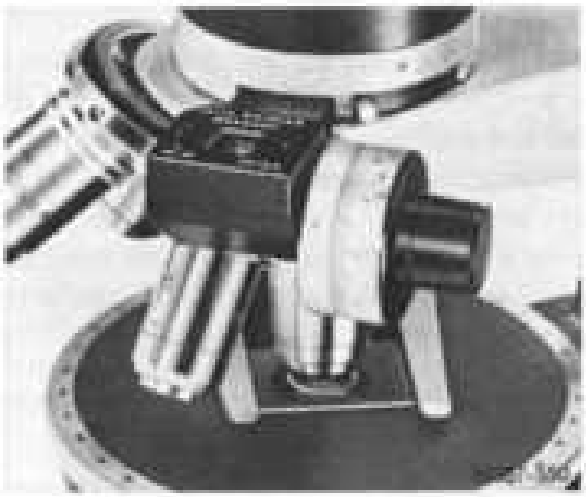

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Fig. 7 Rotary compensator according to Brace-Köhler

2.3 **Conoscopy**

Conoscopy is the observation of the interference phenomena in the rear focal plane of the objective.

For setting a conoscopic image (interference figure) the same manipulations as described under para 2.2 must be carried out. But the following points must be specially considered:

Move the illuminator into its topmost position. Turn in the objective 40/0.65. Focus the object to be examined in the centre of the crosslines (objective centration). Swing in the Bertrand lens (1.4). Focus the interference figure by rotating the eyelens of the eyepiece.

For the conoscopic observation of very small objects the pinhole stop (1.3) must additionally be swung into the light path.

For the determination of the optical character of crystals (positively or negatively birefringent) fixed compensators (λ- and $\lambda/4$-plates), the quartz wedge or the tilting compensators can be used according to the table below.

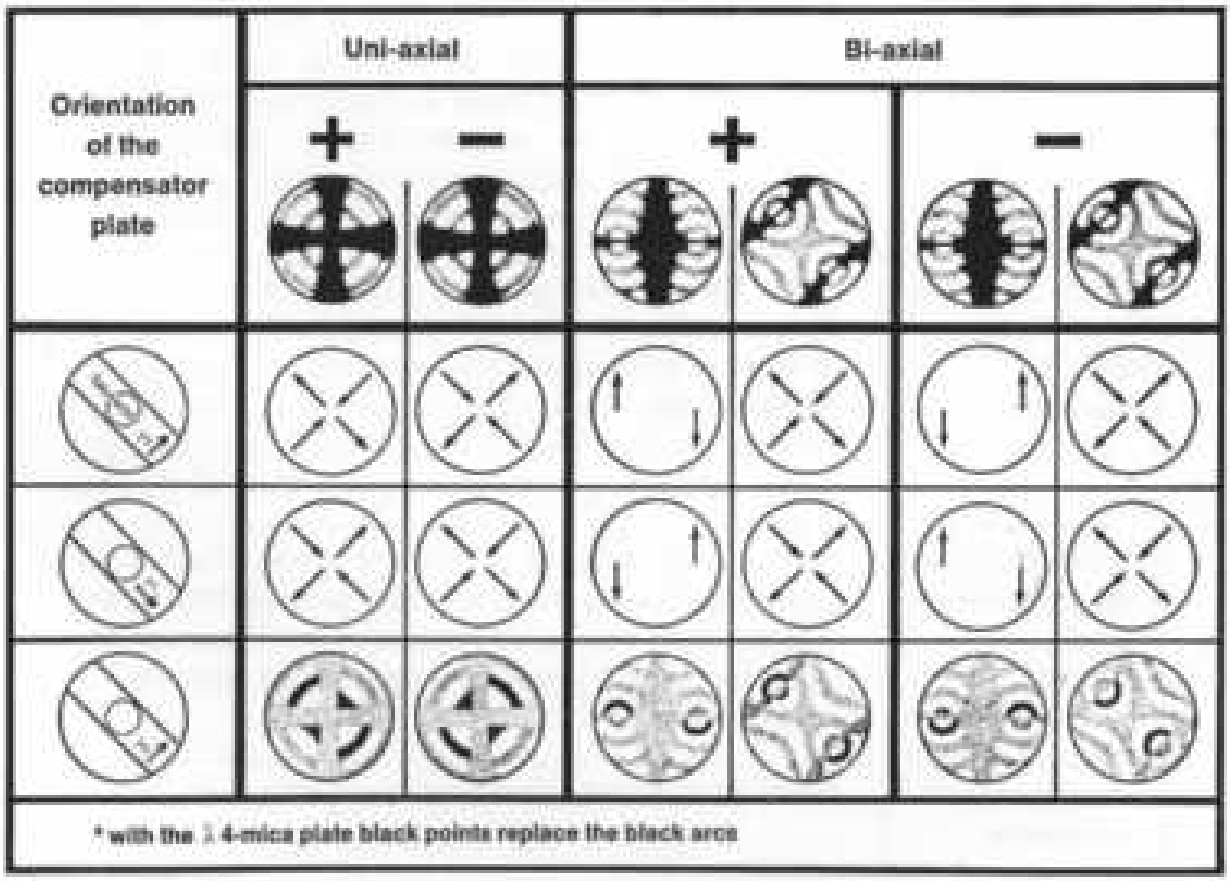

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Fig. 8 Table for the determination of the optical character of a specimen

3 Maintenance

When the microscope is not being used it should always be protected against dust. The dust cover supplied with it is very useful, but for prolonged periods of non-use it is better to store it in a dust-proof cabinet.
For work in tropical, humid climate it is recommended to install a weak source of heat in the storage cabinet. For this purpose ordinary filament lamps (10–25W) can be used and permanently left on. The microscope and its accessories should be returned to this cabinet immediately after use. A few holes should be drilled in the top and bottom of the cabinet to ensure adequate vertilation.

Care of the optical components
The optical components of the microscope must be kept scrupulously clean. It should, however, be borne in mind that very soft anti-reflecting layers are sometimes used for coating internal surfaces of objectives, eyepieces, and condensers. The layers on the external surfaces of micro-optical systems are about as hard as glass. Since all these layers are extremely thin, cleaning must be carried out with appropriate care.
Objectives must not be dismantled for cleaning.
Any damage evident in the interior of optical systems should be dealt with by our factory.

Optical system	Cleaning
External surfaces of objectives, eyepieces, condensers	**Dust:** Remove with soft, dry sable brush. **Fingermarks:** Remove immediately with a damp piece of linen or chamois leather; if necessary use petrol. **Resistant dirt:** Try to remove with damp, fine piece of linen or chamois leather; if it cannot be removed with water, xylene or petrol can be used. Never use alcohol.
External surfaces of the front lenses of plano-objectives	The external surfaces of the front lenses of some plano-objectives are concave. It is best to clean them with a wooden stick around which cotton wool is wrapped. Here, too, water, xylene or petrol can be used for resistant dirt.
Internal surfaces of eyepieces, condensers	**Dust:** Blow it away gently, or clean with sable brush.

Special cases

a) Corrosive substances such as acetic acid etc.

If possible, corrosive substances should not be used on the object stage of the microscope. Even if the objects are protected by a coverglass, the objective is in a constant atmosphere of corrosive fumes. During prolonged exposure the front lens may be attacked and the optical quality considerably impaired. The use of other fixatives etc. is therefore preferable. If this is not feasible, only achromats should be used for examination, since the highly developed types of glass used in apochromats are more sensitive to corrosive substances.

b) Hydrofluoric acid

This etching medium frequently used in metallography presents a considerable danger to optical components, since especially in porous materials small but highly damaging concentrations of hydrofluoric acid collect; they can, however, be removed rapidly and reliably with the following method:

Immerse the etched specimen in a saturated ammonium pentaborate solution for an hour. Rinse well and dry. The specimen is now ready for metallographic examination.

Ammonium pentaborate has been found compatible with numerous metallic, ceramic, metalloid, and semi-conductor specimens which require etching with hydrofluoric acid.

The solution is prepared by dissolution of 9.8g ammonium pentaborate in 100ml distilled water. This solution is 0.36-molar and saturated.

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