ISTITUTO E MUSEO
DI STORIA DELLA SCIENZA

Galileo's microscope

Test

This is the Test material for verifying the contents
of the ***History*** and ***Explore*** sections of the web application.
Texts prepared by the *Institute and Museum of the History of Science* in Florence.

Why a test?

The structured test consists of **40** multiple-choice questions designed to verify the main content of the application.

Galileo's microscope was created for the purpose of furnishing, in an attractive but strictly scientific way, a great body of information on microscopy in the 17th and 18th centuries.
To reinforce the educational effect, it has been deemed useful to provide a tool of evaluation to be used by teachers, or of self-evaluation for others.

For each question, reference is made to the section in which the answer can be found, allowing users the chance to verify the content.

Standard timing for the answers is generally 1 minute for each multiple-choice question (34) and 30 seconds for each true/false question (6). The whole test should thus be completed within 37 minutes.

1. During what period was the microscope invented?

a) □ In the late 15th – early 16th century.
b) □ Around the middle of the 16th century.
c) □ In the late 16th – early 17th century.
d) □ Around the middle of the 17th century.

Reference: HISTORY section – The compound microscope.

2. During what period was the "Galilean" microscope constructed (IMSS inv. 3429)?

a) □ First half of the 17th century.
b) □ Second half of the 17th century.
c) □ First half of the 18th century.
d) □ Second half of the 18th century.

Reference: EXPLORE section – The instrument.

3. Who is attributed with constructing the "Galilean" microscope (IMSS inv. 3429)?

a) □ Galileo Galilei.
b) □ Evangelista Torricelli.
c) □ Eustachio Divini.
d) □ Giuseppe Campani.

Reference: HISTORY section – The microscope game.

4. What function is served by the iron support on the "Galilean" microscope (IMSS inv. 3429)?

a) □ The sole function of support.
b) □ The sole function of focusing.
c) □ Both the function of support and that of focusing.
d) □ Merely a decorative function.

Reference: HISTORY section – The microscope game.

5. The mobile cylinder that houses the field lens of the "Galilean" microscope (IMSS inv. 3429) can be removed from the main optical tube and used alone, as a simple microscope.

a) □ True.
b) □ False.

Reference: EXPLORE section – The instrument.

6. What material are most of the optical tubes of the "Galilean" microscope made of (IMSS inv. 3429)?

a) □ Iron.
b) □ Brass.
c) □ Wood.
d) □ Cardboard.

Reference: EXPLORE section – The instrument.

7. The "Galilean" microscope (IMSS inv. 3429) is equipped with

a) □ three biconvex lenses.

b) □ two biconvex lenses.
c) □ two lenses, a concave one and a convex one.
d) □ a single biconvex lens.

Reference: EXPLORE section – The instrument.

8. Some original ink markings on the outside of the retractable optical tube of the "Galilean" microscope (IMSS inv. 3429) facilitate rough focusing, with an extensive but poorly sensitive travel.

a) □ True.
b) □ False.

Reference: EXPLORE section – The instrument.

9. The "Galilean" microscope (IMSS inv. 3429) is equipped with a mirror to light the microscopic specimens from below.

a) □ True.
b) □ False.

Reference: EXPLORE section – The instrument.

10. In which of his writings did Galileo call the microscope a "telescope adjusted to see objects very close"?

a) □ In the *Starry Messenger*, published in Venice in 1610.
b) □ In the *Assayer*, published in Roma in 1623.
c) □ In the *Dialogue on the two great world systems*, published in Florence in 1632.
d) □ In the *Discourse and mathematical demonstrations on two new sciences*, a work published in Leyden, Netherlands, in 1638.

Reference: HISTORY section – The compound microscope.

11. In 1624 Galileo wrote, "I have contemplated a great many animals with infinite admiration; among them, the flea is most horrible, the mosquito and the moth are beautiful; and with great satisfaction I have seen how flies and other tiny creatures can walk attached to mirrors, and even upside down." To what illustrious personage is the Pisan scientist writing?

a) □ To the Grand Duchess of Tuscany Christine of Loraine, in 1624 regent for her nephew Ferdinand II de' Medici.
b) □ To Prince Federico Cesi, founder of the Accademia dei Lincei and great friend of Galileo.
c) □ To Pope Urban VIII, the former Maffeo Barberini, who received Galileo in an audience expressly in 1624.
d) □ To Cardinal Francesco Barberini, nephew of Pope Urban VIII.

Reference: HISTORY section – A century of discoveries.

12. Around 1956 Federico Allodi took two microphotographs with the "Galilean" microscope (IMSS inv. 3429). One of these showed

a) □ a fragment of a flea's head.
b) □ a fragment of a mosquito's head.
c) □ a fragment of a moth's head.
d) □ a fragment of a fly's head.

Reference: EXPLORE section – Radiographic examination.

13. Which of Galileo's followers credited the Pisan scientist with the invention of both the simple and the compound microscope?

a) □ Bonaventura Cavalieri.
b) □ Clemente Settimi.
c) □ Vincenzo Viviani.
d) □ Evangelista Torricelli.

Reference: HISTORY section – A century of discoveries.

14. Which member of the Accademia dei Lincei christened the instrument, until then called "occhialino", "cannoncino", "perspicillo", or "occhiale", by the name of "microscope"?

a) □ Federico Cesi.
b) □ Francesco Stelluti.
c) □ Giovanni Faber.
d) □ Galileo Galilei.

Reference: HISTORY section – The compound microscope.

15. In what century were the Italian makers of optical instruments Eustachio Divini and Giuseppe Campani active, achieving remarkable results?

a) □ In the 16^{th} century.
b) □ In the 17^{th} century.
c) □ In the 18^{th} century.
d) □ In the 19^{th} century.

Reference: HISTORY section – The compound microscope.

16. Although the microscope originated with two or more lenses, the protagonist of the first research on insects, worms and tiny creatures invisible to the naked eye was the simple microscope, which provided greater magnification and a higher degree of resolution.

c) □ True.
d) □ False.

Reference: HISTORY section – The simple microscope.

17. Of the simple microscopes fabricated by the Dutchman Antoni van Leeuwenhoek, no example survives today.

a) □ True.
b) □ False.

Reference: HISTORY section – The simple microscope.

18. Who described in a mechanical perspective the muscular motions involved in walking, running, and lifting weights, as well as the internal motions of the body?

a) □ Federico Cesi.
b) □ Francesco Stelluti.
c) □ Giovanni Battista Hodierna.
d) □ Giovanni Alfonso Borelli.

Reference: HISTORY section – Microscopic anatomy.

19. Which scientist developed microscopic anatomy in all of its potentiality?

a) □ Galileo Galilei.
b) □ Evangelista Torricelli.
c) □ Antoni van Leeuwenhoek
d) □ Marcello Malpighi.

Reference: HISTORY section – Microscopic anatomy.

20. Who observed under the microscope and described for the first time the alveolar structure of the lungs and the connection between arterial and venous blood vessels?

a) □ Marco Aurelio Severino.
b) □ Giovanni Alfonso Borelli.
c) □ Marcello Malpighi.
d) □ Lazzaro Spallanzani.

Reference: HISTORY section – Microscopic anatomy.

21. In 1625 the *Apiarium* was printed, a work covering a single enormous sheet, containing detailed descriptions of naturalist, historical-erudite and literary nature on bees. To what personage, whose coat of arms is emblazoned with bees, did the work pay homage?

a) □ To Cardinal Federico Eutel of Zollern, to whom Galileo had donated a microscope in 1624 during a meeting held in Rome.
b) □ To Pope Urban VIII, the former Maffeo Barberini, elected to the papal throne on August 6, 1623.
c) □ To Prince Federico Cesi, promoter of studies in botany and naturalist studies in general.
d) □ To the Grand Duchess of Tuscany Christine of Lorraine, in 1624 regent for her nephew Ferdinand II de' Medici.

Reference: HISTORY section – A century of discoveries.

22. Around 1644 Evangelista Torricelli, the Grand Ducal mathematician, designed the "microscope a perlina". It was a

a) □ simple microscope.
b) □ compound microscope.
c) □ variable microscope;
d) □ aquatic microscope.

Reference: HISTORY section – A century of discoveries.

23. In what year was the Accademia del Cimento "officially" instituted?

a) □ 1647.
b) □ 1657.
c) □ 1667.
d) □ 1677.

Reference: HISTORY section – A century of discoveries.

24. Which of the following illustrious personages had no relationship with the Accademia del Cimento?

a) □ Evangelista Torricelli.

b) □ Giovanni Alfonso Borelli.
c) □ Francesco Redi.
d) □ Lorenzo Magalotti.

Reference: HISTORY section – A century of discoveries.

25. Who is attributed with introducing the reflecting mirror to light the objects under observation?
a) □ Francesco Fontana.
b) □ Evangelista Torricelli.
c) □ Eustachio Divini.
d) □ Giuseppe Campani.

Reference: HISTORY section – A century of discoveries.

26. Who described, in 1665–1666, his great discovery of the sensorial receptors?
a) □ Giovanni Alfonso Borelli.
b) □ Francesco Redi.
c) □ Marcello Malpighi.
d) □ Antonio Vallisneri.

Reference: HISTORY section – A century of discoveries.

27. In 1668 the *Esperienze intorno alla generazione degl'insetti* [Experiments on the generation of insects] was published in Florence. It was destined to be a milestone in the history modern science for its confutation of the age-old theory of the spontaneous generation of insects. Who wrote this work?
a) □ Giovanni Alfonso Borelli.
b) □ Francesco Redi.
c) □ Marcello Malpighi.
d) □ Antonio Vallisneri.

Reference: HISTORY section – A century of discoveries.

28. The *De motu animalium*, a treatise in mechanistic physiology based on the corpuscular nature of matter, represented the attempt to extend to the biological sphere the rigorous style of geometric analysis employed by Galileo in the mechanistic field. Who was the author of this work?
a) □ Giovanni Alfonso Borelli.
b) □ Francesco Redi.
c) □ Marcello Malpighi.
d) □ Antonio Vallisneri.

Reference: HISTORY section – A century of discoveries.

29. Which type of microscope, among those listed below, has a sophisticated lighting system formed of an oil lamp, a spherical water lens and a piano-convex lens that acts as condenser?
a) □ Hooke type microscope.
b) □ Bonanni's horizontal microscope.
c) □ Culpeper type microscope.
d) □ Cuff type microscope.

Reference: HISTORY section – The microscope game.

30. In the late 17th century, a complex horizontal microscope was fabricated, equipped with a mobile condenser that reflected the light from an oil lamp. Who is credited with having designed this particular microscope?

a) □ Robert Hooke.
b) □ Antoni van Leeuwenhoek.
c) □ Filippo Bonanni.
d) □ Johann van Musschenbroek.

Reference: HISTORY section – The microscope game.

31. The Culpeper type microscope was usually furnished with a typical case in the shape of a

a) □ pyramid.
b) □ trapezoid.
c) □ rectangular box.
d) □ square box.

Reference: HISTORY section – The microscope game.

32. The simple microscope of the Leeuwenhoek type has a tiny lens that is

a) □ piano-convex.
b) □ piano-concave.
c) □ biconcave.
d) □ biconvex.

Reference: HISTORY section – The microscope game.

33. Which of the following microscopes has the characteristic stage with articulated arm that also serves as device for focusing on the object observed?

a) □ Culpeper type microscope.
b) □ Cuff type microscope.
c) □ Solar microscope.
d) □ Compass microscope.

Reference: HISTORY section – The microscope game.

34. In the first half of the 19th century, the optical performance of the microscope was decidedly improved when the problems of spherical and chromatic aberration were solved, also thanks to the contribution of the Italian scientist

a) □ Vincenzo Antinori.
b) □ Giovanni Antonelli.
c) □ Giovan Battista Amici.
d) □ Eugenio Barsanti.

Reference: HISTORY section – The compound microscope.

35. How many optical elements does the compound microscope contain in its classic version?

a) □ 1.
b) □ 2.
c) □ 3.
d) □ 4.

Reference: EXPLORE section – How it works.

36. Which lens in the compound microscope helps the eye to see the intermediate image produced by the objective?

a) □ The field lens.
b) □ The eyepiece.
c) □ The condenser lens.

Reference: EXPLORE section – How it works.

37. Which lens serves the function of deviating the rays coming from the peripheral regions of the object observed in such a way that they are all intercepted by the eyepiece and enter the pupil of the eye?

a) □ Field lens.
b) □ Objective.
c) □ Condenser lens.

Reference: EXPLORE section – How it works.

38. Which lens in the compound microscope collects the diffused light from the object and forms an intermediate image of it?

a) □ Eyepiece.
b) □ Field lens.
c) □ Objective.
d) □ Condenser lens.

Reference: EXPLORE section – How it works.

39. The overall magnification of the microscope is given by the product of that of the objective and that of the eyepiece.

a) □ True.
b) □ False.

Reference: SIMULATION section – Magnification.

40. Which lens has the greatest effect on the resolution of the microscope?

a) □ Eyepiece.
b) □ Field lens.
c) □ Objective lens.

Reference - SIMULATION section - Resolution.

Correct answers:

1. c
2. b
3. d
4. c
5. true
6. d
7. a
8. true
9. false
10. b
11. b
12. c
13. c
14. c
15. b
16. true
17. false
18. d
19. d
20. c
21. b
22. a
23. b
24. a
25. c
26. c
27. b
28. a
29. a
30. c
31. a
32. d
33. d
34. c
35. c
36. b
37. a
38. c
39. true
40. c