

Biology
Microscope Reading Assignment

Name: _____

Date: _____ Hour: _____

Read the following article and answer the questions:

***History of Microscopes (adapted from
<http://www.microscope.com/education-center/microscopes-101/history-of-microscopes/>)***

The origin of the word microscope according to the Online Etymology Dictionary is as follows: “an instrument for viewing what is small”, from Greek micro - means of viewing, and skopien - look at. The word microscopic is attested from the 1760’s.

What do you think the word attested means? _____

According to an ancient Chinese text, the Chinese viewed magnified specimens through a lens at the end of a tube, which was filled with varying levels of water according to the degree of magnification they wished to achieve. Ingenious, effective and repeatable in the home, today. That this occurred some 4,000 years ago in the Chow-Foo dynasty and more than 3,500 years before the “father of microscopy” was born is quite remarkable.

Why do you think that it is so remarkable that the Chinese made a telescope 4,000 years ago? _____

No less a person than Aristotle describes the workings of a microscope in some detail. The Greeks certainly made good use of curved lenses, which are an essential component of any stereo or compound microscope. Ancient Greek boys probably shared every American boy’s sense of triumph of using a curved lens, or magnifying glass, to start a fire. The Greeks, however, also used it for surgical procedures, not on ants as little boys are wont to do, but on people - to cauterize wounds and lesions caused by leprosy and so forth.

The word ‘wont’ is used here to explain what about ants and little boys? _____

Incredibly, the next historical references with anything at all to do with microscopes, or more accurately optics, is 1,200 years after Rome was sacked and, even then, references are only to the use of lense in the invention of spectacles. Within just a few short years in Tuscany, Italy, two men claimed to have independently invented spectacles. The evidence? Their tombstones. Finally in 1289, another local from Italy bemoaned that “I am so debilitated by age that without the glasses known as spectacles, I would no longer be able to read or write.”

What are spectacles? _____

How do you think spectacles relate to a microscope? _____

But what of microscopes? In the late 1590's, a father and son used several lenses in a tube and were amazed to see that the object at the end of the tube was magnified significantly beyond the capability of a magnifying glass. They had just invented the compound microscope. That is to say, they had discovered that an image magnified by a single lens can be further magnified by a second or more lenses.

Then in the mid 17th century, an Englishman, Robert Hooke and a Dutchman, Anthony Van Leeuwenhoek took the microscope to new levels. Hooke was a sickly genius who loved to experiment. He did so across a huge range of scientific fields of study and with prolific success. He invented the universal joint, the iris diaphragm (a key component of modern light microscopes), a respirator, an anchor escapement and balance spring for clocks.

What does the authors mean when they say Hooke and Van Leeuwenhoek "took the microscope to new levels"?

It was Leeuwenhoek, however, who lived at the same time as Hooke and drew on Hooke's work to take microscope design to new levels of sophistication. As a draper, he used a simple microscope to examine cloth. As a scientist, he began to experiment with new ways of grinding lenses in order to improve the optical quality. In total, he ground some 550 lenses, some of which had a linear magnifying power of 500 and a resolving power of one-millionth of an inch - an astounding achievement.

Why do you believe the authors call the resolving power of Hooke's microscope "an astounding achievement"?

At the turn of the 19th/20th centuries Louis Pasteur invented pasteurization while Robert Koch discovered his famous or infamous postulates: the anthrax bacillus, the tuberculosis bacillus and the cholera vibrio using the light microscope. By 1900, the theoretic limit of resolution for visible light microscopes had been reached. In 1931, Max Knoll and Ernst Ruska invented the first electron microscope that blasted past the optical limitations of the light. Physics dictates that light microscopes are limited by the physics of light to 500X and 1000X magnification. Knoll and Ruska built a transmission electron microscope (TEM) - that transmits a beam of electrons through the specimen. The subsequent interaction of the beam of electrons with the specimen is recorded and transformed into an image. Then, in 1942, Ruska improved on the TEM by building the first scanning electron microscope (SEM) that transmits a beam of electrons across the specimen. Ruska's principles still form the basis of modern electron microscopes - microscopes that can achieve magnification levels of up to 2 million times!

What is the purpose of closing out this reading by using the last paragraph? _____
