2.5: How We See the Invisible World (Exercises)

2.1: The Properties of Light

Which of the following has the highest energy?

1. light with a long wavelength
2. light with an intermediate wavelength
3. light with a short wavelength
4. It is impossible to tell from the information given.

C

You place a specimen under the microscope and notice that parts of the specimen begin to emit light immediately. These materials can be described as _____________.

1. fluorescent
2. phosphorescent
3. transparent
4. opaque

A
**Fill in the Blank**

When you see light bend as it moves from air into water, you are observing _________.

refraction

**Short Answer**

Explain how a prism separates white light into different colors.

**Critical Thinking**

In Figure, which of the following has the lowest energy?

1. visible light
2. X-rays
3. ultraviolet rays
4. infrared rays

**2.2: Peering into the Invisible World**

**Short Answer**

Why is Antonie van Leeuwenhoek’s work much better known than that of Zaccharias Janssen?

Why did the cork cells observed by Robert Hooke appear to be empty, as opposed to being full of other structures?

**Multiple Choice**

Who was the first to describe “cells” in dead cork tissue?

1. Hans Janssen
2. Zaccharias Janssen
3. Antonie van Leeuwenhoek
4. Robert Hooke
Who is the probable inventor of the compound microscope?

1. Girolamo Fracastoro
2. Zaccharias Janssen
3. Antonie van Leeuwenhoek
4. Robert Hooke

B

Fill in the Blank

A microscope that uses multiple lenses is called a ________ microscope.

compound

2.3: Instruments of Microscopy

Which would be the best choice for viewing internal structures of a living protist such as a *Paramecium*?

1. a brightfield microscope with a stain
2. a brightfield microscope without a stain
3. a darkfield microscope
4. a transmission electron microscope

C

Which type of microscope is especially useful for viewing thick structures such as biofilms?

1. a transmission electron microscope
2. a scanning electron microscopes
3. a phase-contrast microscope
4. a confocal scanning laser microscope
5. an atomic force microscope

D
Which type of microscope would be the best choice for viewing very small surface structures of a cell?

1. a transmission electron microscope
2. a scanning electron microscope
3. a brightfield microscope
4. a darkfield microscope
5. a phase-contrast microscope

B

What type of microscope uses an annular stop?

1. a transmission electron microscope
2. a scanning electron microscope
3. a brightfield microscope
4. a darkfield microscope
5. a phase-contrast microscope

E

What type of microscope uses a cone of light so that light only hits the specimen indirectly, producing a darker image on a brighter background?

1. a transmission electron microscope
2. a scanning electron microscope
3. a brightfield microscope
4. a darkfield microscope
5. a phase-contrast microscope

D

Fill in the Blank

Chromophores that absorb and then emit light are called __________.

fluorochromes
In an _______ microscope, a probe located just above the specimen moves up and down in response to forces between the atoms and the tip of the probe.

atomic force microscope

What is the total magnification of a specimen that is being viewed with a standard ocular lens and a 40? objective lens?

400?

**Short Answer**

What is the function of the condenser in a brightfield microscope?

Label each component of the brightfield microscope.

**Critical Thinking**

When focusing a light microscope, why is it best to adjust the focus using the coarse focusing knob before using the fine focusing knob?

You need to identify structures within a cell using a microscope. However, the image appears very blurry even though you have a high magnification. What are some things that you could try to improve the resolution of the image? Describe the most basic factors that affect resolution when you first put the slide onto the stage; then consider more specific factors that could affect resolution for 40? and 100? lenses.

**2.4: Staining Microscopic Specimens**

**Multiple Choice**

What mordant is used in Gram staining?

1. crystal violet
2. safranin
3. acid-alcohol
4. iodine
What is one difference between specimen preparation for a transmission electron microscope (TEM) and preparation for a scanning electron microscope (SEM)?

1. Only the TEM specimen requires sputter coating.
2. Only the SEM specimen requires sputter-coating.
3. Only the TEM specimen must be dehydrated.
4. Only the SEM specimen must be dehydrated.

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**Fill in the Blank**

Ziehl-Neelsen staining, a type of _______ staining, is diagnostic for *Mycobacterium tuberculosis*.

The _______ is used to differentiate bacterial cells based on the components of their cell walls.

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**Short Answer**

How could you identify whether a particular bacterial sample contained specimens with mycolic acid-rich cell walls?

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**Critical Thinking**

You use the Gram staining procedure to stain an L-form bacterium (a bacterium that lacks a cell wall). What color will the bacterium be after the staining procedure is finished?