Jonathan Lam
Mrs. McTague
H Bio. per. 3
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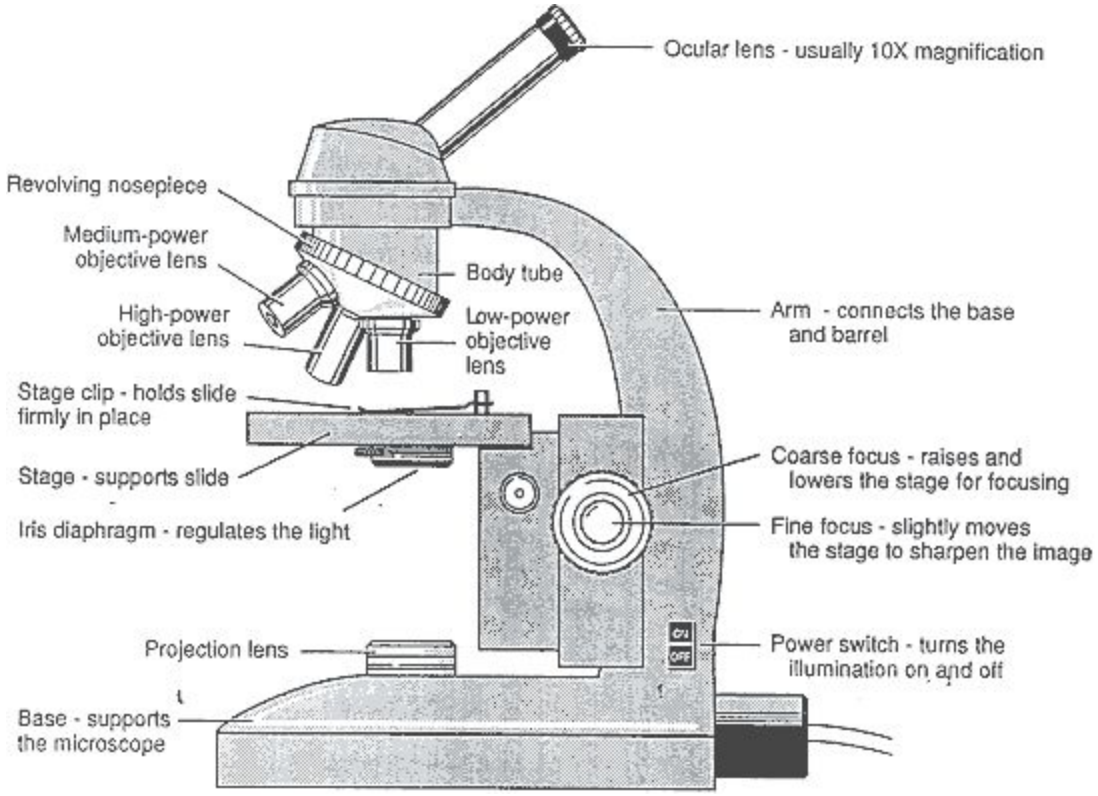
Microscopes Quiz Study Guide

1. **Label a diagram of the compound light microscope.**



2. **State the function(s) for each part of the compound light microscope.**
    a. ocular lens (10x): magnify a little bit
    b. arm: connect barrel, adjustment knobs, and the base, hold here
    c. objective lenses: add much more magnification
        i. scanning objective lens (4x): lowest power, find object, scan most of stage; mostly use coarse adjustment knob
        ii. low power objective lens (10x): medium power, for medium uses; can use both knobs (after using scanning)
        iii. high power objective lens (40x): very high power, to see very small items; only use fine adjustment knob (after using low power)
    d. rotating nosepiece: switch between different objective lens
    e. stage: a moving flat surface that supports the slide and is controlled by the focus knobs
    f. stage clips: used to stabilize the slide
    g. diaphragm: control the amount of light that goes through the slide, so that the image is the most in focus
    h. adjustment knobs: control the movement of the stage
        i. fine adjustment knob: adjust the stage very slowly, especially for the high power lens, and a little bit of the low power lens
        ii. course adjustment knob: adjust the stage quickly, especially for the scanning lens, and a little bit of the low power lens
    i. light/mirror: allow the specimen to be illuminated

j. base: supports the microscope and keeps it steady

3. Explain the proper use and care of the compound light microscope.

a. Use both hands to carry a microscope.
b. Make sure a microscope will not fall by placing it far from the edge of the table and watching the power cord.
c. Start with stage rolled down, and scanning objective lens down, and then place the slide on the stage.
d. Roll the stage as far up as it can go (carefully and slowly, and watch it).
e. Look through the ocular and bring the object into focus with the coarse adjustment knob.
    i. If low-power is needed, (leave the stage position and) switch the lens and use the fine-adjustment knob only. If high-power is needed, start with low-power and do the same steps. Only use the fine adjustment.
f. To clean up:
    i. Put the scanning lens down and the stage down.
    ii. Clean the lens with lens paper.
    iii. Wrap the cord (securely).
    iv. Cover the microscope with the plastic cover.

4. Calculate the total magnification when given the magnification of the ocular lens and an objective lens.

a. Multiply:

	Ocular (10x)
Scanning Objective (4x)	40x
Low-power Objective (10x)	100x
High-power Objective (40x)	400x

5. Calculate the diameter of a field of view in both mm and µm (for example at 40X or 400X) when provided with the diameter of the field of view at a different magnification (for example at 100X).

a. Field of view and magnification are inversely proportional. Just multiply and divide:

Power	FOV (mm)	FOV (µm)
40x	5	5000
100x	2	2000
400x	0.5	500

6. Determine the size of an object based on the determined diameter of a field of view.

a. Divide the diameter of the FOV by the number of times an object can fit in that diameter.

7. Describe and draw how the orientation of an object changes when viewed under a compound light microscope.

a. Objects are rotated 180º. This also applies to movement of the slide: all movements seemed reversed (flipped both laterally and longitudinally).

8. **Describe and draw how the field of view changes from magnification to magnification.**
    a. The FOV decreases as magnification increases, and is inversely proportional. For example, the FOV of a 40x can be 5mm, and the FOV of 400x can be 0.5mm (10^1 higher magnification = 10^{-1} FOV).

9. **Describe and illustrate how the depth of field changes as the magnification increases.**
    a. Depth of field gets smaller, similar to FOV, as magnification increases. Being more specific, the increased magnification can only focus on a smaller area, in all three dimensions. Therefore, an object that seems in focus in scanning mode may not be in focus or even in view in the low power or high power lenses, while any object in focus in the high or low power lenses will be in focus with the scanning objective.

10. **Explain how to adjust the stage to bring the different layers of a specimen into focus at high magnifications.**
    a. If you want to bring a lower object into focus, you must move the stage up, so that the longer distance between the lens and the object will shorten to become the focal distance, and vice versa.

11. **Compare and contrast the compound light microscope, stereoscope, and electron microscope. Discuss their magnifications, the objects they are used to view, how they work, and their advantages and disadvantages.**
    a. Stereoscope
        i. has two views of the same object with different perspectives, creating parallax and a sense of depth
    b. Compound Light Microscope
        i. focuses beams of light
        ii. commonly used, not too expensive
        iii. acceptable magnification
        iv. does not kill a specimen
        v. in color
        vi. only can see a layer (in high resolution; at lower magnifications, can see the outside)
    c. Electron Microscope
        i. focuses, reflects, and returns beams of electrons
        ii. very expensive, not very common (needs a powerful computer and much equipment)
        iii. much higher magnification
        iv. kills a specimen
        v. in black and white
        vi. can see the surface of an object, or a layer (both in high resolution)
        vii. two types: SEM (surface) and TEM (one layer)