**Exercise #7 : Crash Course in** **SEM basics**

*Chem 6614 Chemical Instrumentation*

**Basic Theory**

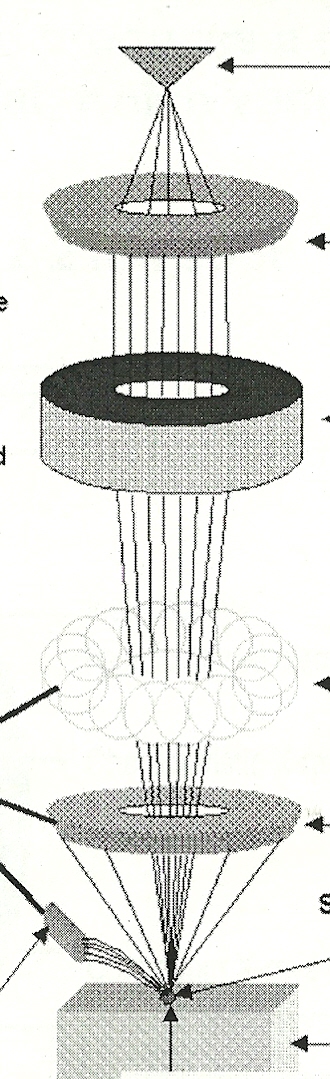
7.0 Why does λ = h/mv guarantee that an SEM is better than an optical microscope ?

**Basic Resolution and Magnification**

7.1 What is the ~minimum theoretical resolution of an SEM in nm? \_\_\_\_\_\_\_\_\_\_\_\_

7.2 What is the practical resolution of an SEM in nm ? \_\_\_\_\_\_\_\_\_\_\_\_

7.3. What is the ~ practical magnification range typical of an SEM ? \_\_\_\_\_\_\_\_\_\_\_\_



**Basic SEM Design**

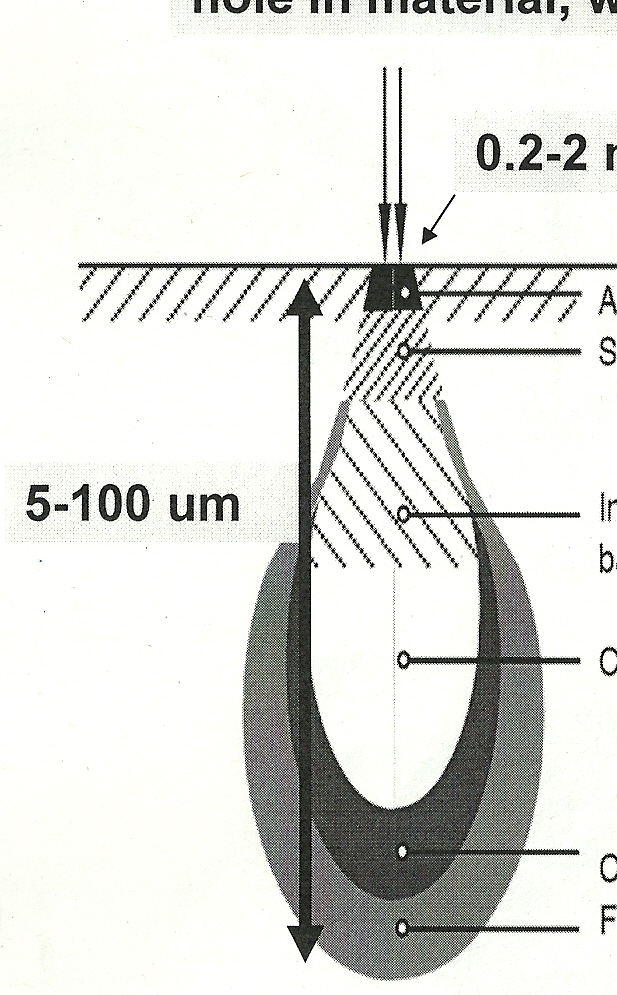
7.4 Place the terms below (using letters) with their position on the diagram of

An SEM to the right:

1. Scanning coils b) stage + specimen c) Magnetic lens d) Anode

e) back scattered/SE electron detector f) electron gun

**Beam Spot geography**



e- beam

7.5 Indicate from what level (1 or 2)

nm

the following electrons emit:

1

1. (inelastically) back scattered electrons
2. Secondary emitted electrons

2

**SEM Images and add-ons**

7.6 What two major imaging sources are used in an SEM ?

a) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

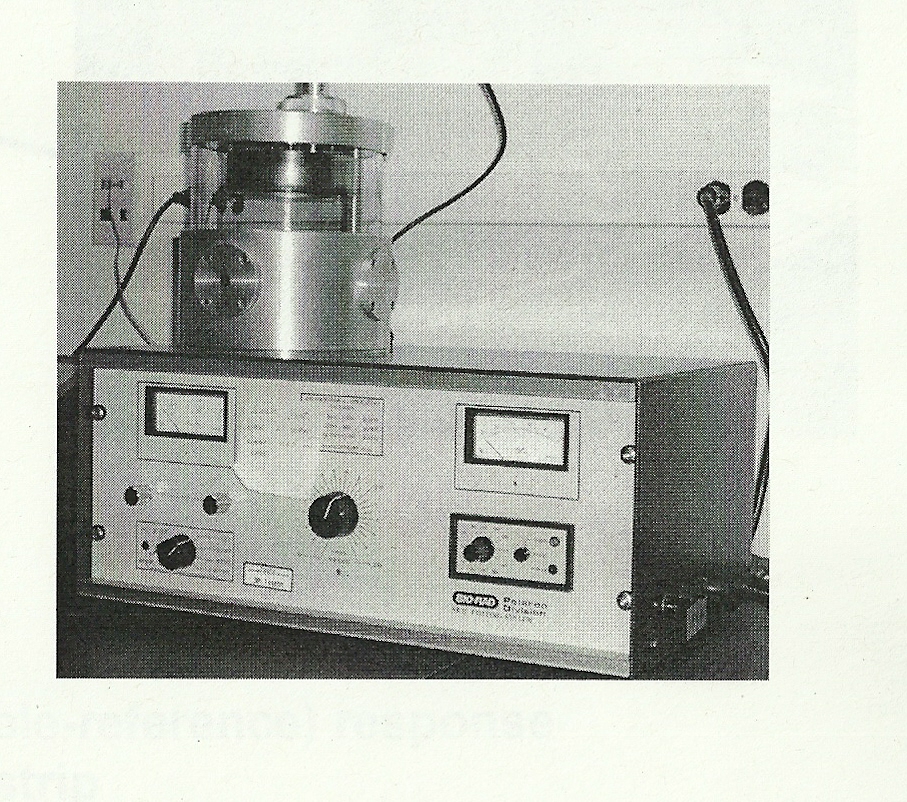
7.7a Of the two images collected, which is the main source of the 3D topographical pictures like those taken of a spider mite and the surface of cheese ?

7.7b Of the two images collected, which provides compositional maps of the surface, but has poor depth of field ?

7.8 What `add-on’ supplies semi-quantitative data about the elemental composition of the observed SEM spot ? (acronym and full name)

7.9. What is a `scan’ of a sample across the surface called in SEM-speak ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**SEM sample details**



The item to the right is a common sight in an SEM lab. What does do and why ?

[](http://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwiR4rf0ofbLAhVhuoMKHWjYA2MQjRwIBw&url=http://binoculas.net/sem-scanning-electron-microscope/&psig=AFQjCNEk2iSTENTOb-xCqrnrnIgxzlek7g&ust=1459903334726507)

A

B

C

Screen 1

Screen 2

7.10) Match us with the pieces in the picture



XRED detector \_\_\_\_\_

Secondary electron detector \_\_\_\_\_

main electron focusing optics \_\_\_\_\_\_

7.11a) Which monitor is likely to show the SEM image ?

1 or 2

7.11b) Which monitor is likely connected to elemental 7.11c What do I do ?

analysis ?

1 or 2

7.12) Why must biological and non-conductive samples be `coated’ with films of gold or carbon for SEM imaging ?