

Sample  
GenSci 102: Test # 2  
Rock Cycle - Part 1

Total points = 237

GENSCI 102A - ENVIRONMENT EARTH

The Rock Cycle

PART ONE - MINERALS AND IGNEOUS ROCKS

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**INSTRUCTIONS:**

- (A) **Write your social security number on the Scantron card.** Your test score will be sent to you via e-mail. If you do not have e-mail, you can see me for your score
- (B) Note that your test **score** is not your test **grade**. Check with the posted curve to convert your test score into a grade.
- (C) **Timing:** you have exactly the class time to take the test, no more.

The questions are a mixture of True/False and Multiple Choice questions. The different kinds of questions are mixed through the test.

- ☞ Multiple choice questions may have 3, 4, 5, or as many as 20 choices. When there are more than 5 choices they are distributed among more than one question number; e.g. question 24 has choices 1-5, question 25 choices 6-10, etc.
- ☞ Different questions may have different values, as indicated with each set of questions.
- ☞ Drawing, diagrams, figure required for certain questions are often at the back of the test. You may pull that sheet off to make it easier to answer questions.

☞ Observe that on some of the questions the scoring will be "rights minus wrongs." Such questions are labeled. That is, you get points for a right answer, zero for no answer, and a negative score for wrong answers. Don't guess!

☞ Wrong spellings are not part of the test. I do not deliberately make minor errors, or try to be confusing or ambiguous. If something seems strange assume it is an honest mistake and answer the question as best you can.

☞ However, questions may be subtle and complex, read them carefully.

**Note that your grade for the test will be based on a curve drawn over the distribution of raw scores. I draw the curve by hand, but have no need to have a specific percentage of A's, B's, C's etc. In fact, I would like everyone to do well, but will draw the most fair curve I can based on how everyone in the class does. I ignore the computer generated percentages.**

**Your raw score will be sent to you via e-mail. The raw score is not your grade, but I will send the curve ranges to you also so you have an idea how you did. Check the bulletin board opposite my office (Miller 233) for the final curve.**

## THE ELEMENTS AND THEIR CHEMISTRY

**TRUE/FALSE QUESTIONS: 2 points each, 22 points total:** “A” is True. “B” is False. Below is a copy of the periodic table. Some of these question refer to elements identified on that table.

1A

1 H																	2 He	1						
2A																		3A 4A 5A 6A 7A						
3 Li	4 Be																	5 B	6 C	7 N	8 O	9 F	10 Ne	2
11 Na	12 Mg																	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar	3
V W		3B 4B 5B 6B 7B	8						1B 2B							X		Y						
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr	4						
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe	5						
55 Cs	56 Ba	57 La	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Ti	82 Pb	83 Bi	84 Po	85 At	86 Rn	6					
87 Fr	88 Ra	89 Ac	104 Unq	105 Unp	106 Unh	107 Uns							109 Une							7				

1. The number of valence electrons is equal to the number of slots available in the outermost shell.
2. For chemical bonding, the octet rule is not as important as electrical neutrality.
3. Bonding in an atom is determined by the total number of protons in the nucleus.
4. Silicon has 4 valence electrons and thus bonds covalently with oxygen, but ionically with metallic cations.
5. The elements in the periodic table are most reasonably arranged by the number of valence electrons.
6. The transition elements exist because their subshells allow more than 8 valence electrons.
7. We would expect elements “V” and “Y” to bond ionically.
8. Element “X” is more likely to bond with element “U” than with element “V”.
9. The electrical charge of an atom is determined by the number of valence electrons it has.
10. Same as 4 - Silicon has 4 valence electrons and thus bonds covalently with oxygen, but ionically with metallic cations.
11. Element "W" in the periodic table above has 12 protons, but only 2 valence electrons.

## THE STATES OF MATTER AND MINERALS

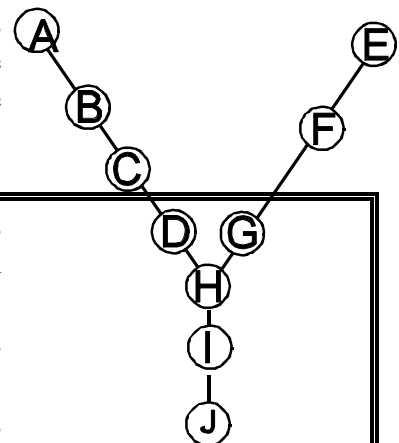
TRUE/FALSE: 2 points each, 16 points total:

12. All minerals are crystalline solids, and all solids are minerals.
13. The state of a complex attractor probably only exists at the solid to liquid transition.
14. Both liquids and gasses expand to fill the container they occupy.
15. The creation of a mixture always involves an exchange of electrons.
16. Crystals always break along the same planes that they grow.
17. Olivine has no cleavage because it possesses too many covalent bonds.
18. In the discontinuous series of minerals in Bowen's Reaction Series the number of covalent bonds increases from top to bottom.
19. In the plagioclase feldspars Na substitutes for Ca because they have the same ionic charge.

## BOWEN'S REACTION SERIES AND ROCK FORMING MINERALS

MULTIPLE CHOICE: 3 points each, 24 points total:

Projected on the screen is a series of illustrations labeled "Features of Silicate Minerals." To the right is an outline drawing of Bowen's Reaction Series with the minerals identified alphabetically. For the questions below identify the "feature" which is best associated with the mineral.



**Mineral A in Reaction Series:** Identify from the overhead [Features of Silicate Minerals] the one illustration which best fits with this mineral from the Reaction Series.

20. A=1A, B=1B, C=1C, D=1D, E=none of the choices in this row.
21. A=2A, B=2B, C=2C, D=omit, E=none of the choices in this row.

**Mineral C in Reaction Series:** Identify from the overhead [Features of Silicate Minerals] the one illustration which best fits with this mineral from the Reaction Series.

22. A=1A, B=1B, C=1C, D=1D, E=none of the choices in this row.
23. A=2A, B=2B, C=2C, D=omit, E=none of the choices in this row.

**Mineral F in Reaction Series:** Identify from the overhead [Features of Silicate Minerals] the one illustration which best fits with this mineral from the Reaction Series.

24. A=1A, B=1B, C=1C, D=1D, E=none of the choices in this row.
25. A=2A, B=2B, C=2C, D=omit, E=none of the choices in this row.

**Mineral J in Reaction Series:** Identify from the overhead [Features of Silicate Minerals] the one illustration which best fits with this mineral from the Reaction Series.

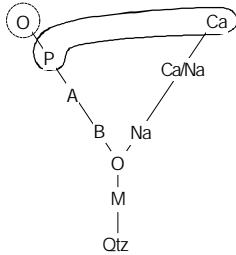
26. A=1A, B=1B, C=1C, D=1D, E=none of the choices in this row.

27. A=2A, B=2B, C=2C, D=omit, E=none of the choices in this row.

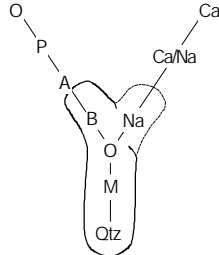
**RIGHTS MINUS WRONGS: MULTIPLE CHOICE: 3 points each, 36 points total:**

Below are a series of **Bowen's Reactions Series** For each rock named in the questions below identify the Reaction Series best associated with the rock name.

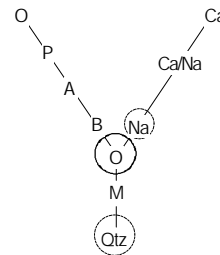
1A



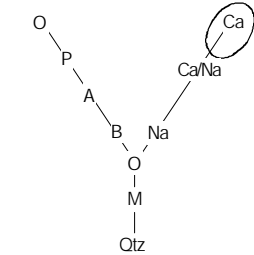
1B



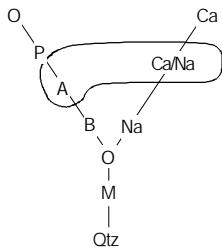
1C



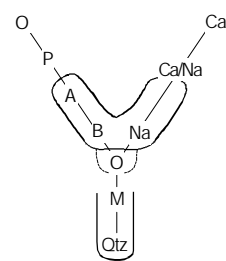
1D



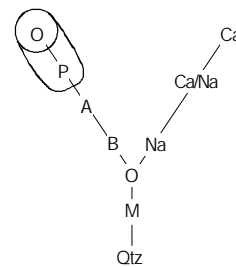
2A



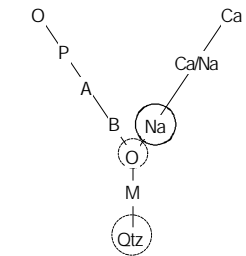
2B



2C



2D



**PLAGIOGRANITE:** Identify from the Reaction Series above the **ONE** which best fits with this rock.

28. A=1A, B=1B, C=1C, D=1D, E=none of the choices in this row.

29. A=2A, B=2B, C=2C, D=2D, E=none of the choices in this row.

**DIORITE:** Identify from the Reaction Series above the one which best fits with this rock.

30. A=1A, B=1B, C=1C, D=1D, E=none of the choices in this row.

31. A=2A, B=2B, C=2C, D=2D, E=none of the choices in this row.

**PERIDOTITE:** Identify from the Reaction Series above the one which best fits with this rock.

32. A=1A, B=1B, C=1C, D=1D, E=none of the choices in this row.

33. A=2A, B=2B, C=2C, D=2D, E=none of the choices in this row.

**SYENITE:** Identify from the Reaction Series above the one which best fits with this rock.

34. A=1A, B=1B, C=1C, D=1D, E=none of the choices in this row.

35. A=2A, B=2B, C=2C, D=2D, E=none of the choices in this row.

**GABBRO:** Identify from the Reaction Series above the one which best fits with this rock.

36. A=1A, B=1B, C=1C, D=1D, E=none of the choices in this row.

37. A=2A, B=2B, C=2C, D=2D, E=none of the choices in this row.

**ALKALIGRANITE:** Identify from the Reaction Series above the one which best fits with this rock.

38. A=1A, B=1B, C=1C, D=1D, E=none of the choices in this row.

39. A=2A, B=2B, C=2C, D=2D, E=none of the choices in this row.

## EXTRUSIVE AND INTRUSIVE IGNEOUS ROCKS

**TRUE/FALSE: 2 points each, 10**

**points total:** To the right is the drawing of igneous rock distribution we studied in class. The questions below refer to this diagram.

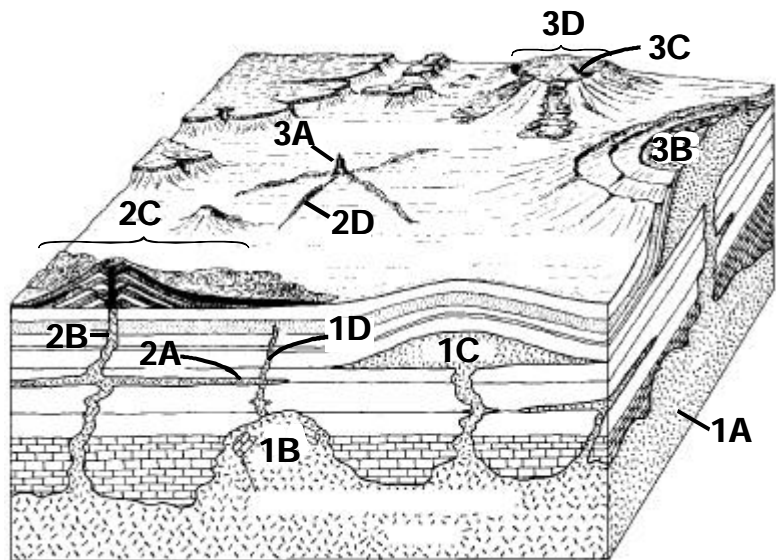
40. **Feature 2D** is discordant.

41. **Feature 1B** would likely possess columnar jointing.

42. **Feature 2C** is a caldera.

43. **Feature 3B** is largely made of pyroclastics.

44. **Feature 1A** is most likely to be composed of gabbro.



**RIGHTS MINUS WRONGS: MULTIPLE CHOICE: 3 points each, 9 points total:**

**Location 3A** in the block diagram is which one of the following 12 choices.

45. A=Batholith, B=Caldera, C=Cinder cone, D=Composite volcano, E=Dike

46. A=Fissure volcano B=Laccolith, C=Lava flow, D=Pipe E=Shield Volcano

47. A=Sill, B=Stock,

**Location 1A** in the block diagram is which one of the following 12 choices.

48. A=Batholith, B=Caldera, C=Cinder cone, D=Composite volcano, E=Dike

49. A=Fissure volcano B=Laccolith, C=Lava flow, D=Pipe E=Shield Volcano

50. A=Sill, B=Stock,

**Location 3B** in the block diagram is which one of the following 12 choices.

51. A=Batholith, B=Caldera, C=Cinder cone, D=Composite volcano, E=Dike

52. A=Fissure volcano B=Laccolith, C=Lava flow, D=Pipe E=Shield Volcano

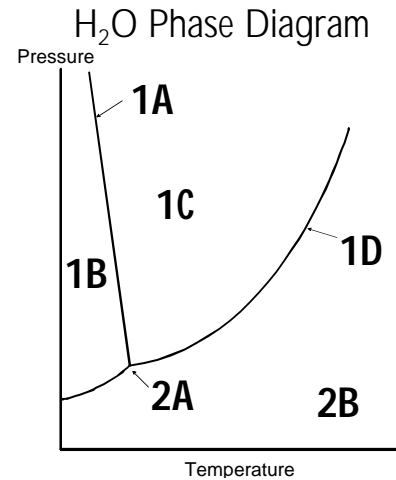
53. A=Sill, B=Stock,

## PHASE DIAGRAMS

**TRUE/FALSE: 2 points each, 6 points total:**

These questions involve interpretation of the H<sub>2</sub>O phase diagram.

54. T/F This diagram has 3 components.  
 55. T/F This diagram has 2 variables.  
 56. T/F 2B is a periodic attractor.



**RIGHTS MINUS WRONGS: MULTIPLE CHOICE: 3 points each, 24 points total:**

Identify by the letter the place(s) where two phases exist in equilibrium.

57. A=1A, B=1B, C=1C, D=1D, E=omit  
 58. A=2A, B=2B, C=omit, D=omit, E=omit

Identify by the letter the area which has the highest "r" value [as in  $X_{next}$ ].

59. A=1A, B=1B, C=1C, D=1D, E=omit  
 60. A=2A, B=2B, C=omit, D=omit, E=omit

Identify by letter all areas which are in the chaotic realm.

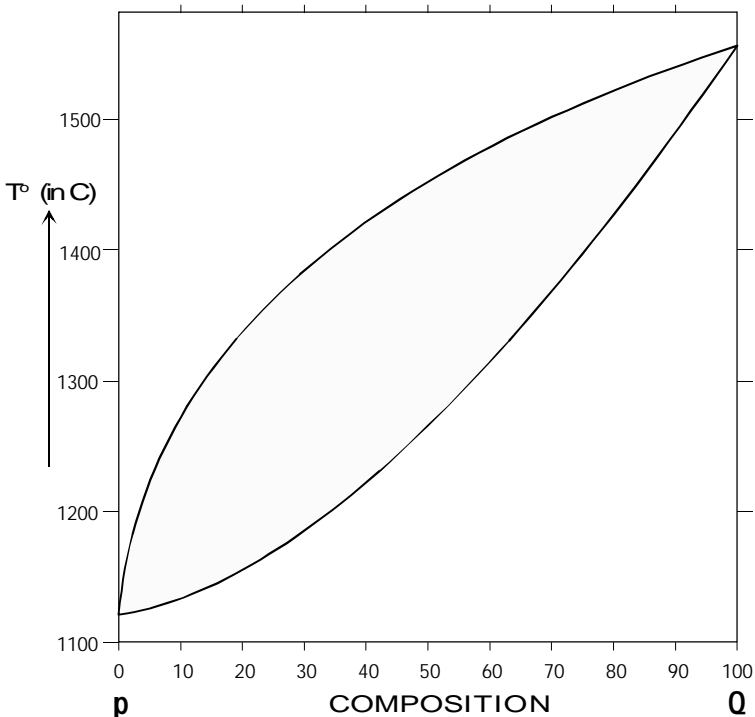
61. A=1A, B=1B, C=1C, D=1D, E=omit  
 62. A=2A, B=2B, C=omit, D=omit, E=omit

Identify by letter the area in the complexity realm between a fixed and a chaotic attractor.

63. A=1A, B=1B, C=1C, D=1D, E=omit  
 64. A=2A, B=2B, C=omit, D=omit, E=omit

**MULTIPLE CHOICE: 3 points each, 14 points total:**

To the right is a solid solution phase diagram. A rock of composition **80% Q** is heated until it begins to melt. The following questions concern the outcomes of these processes.

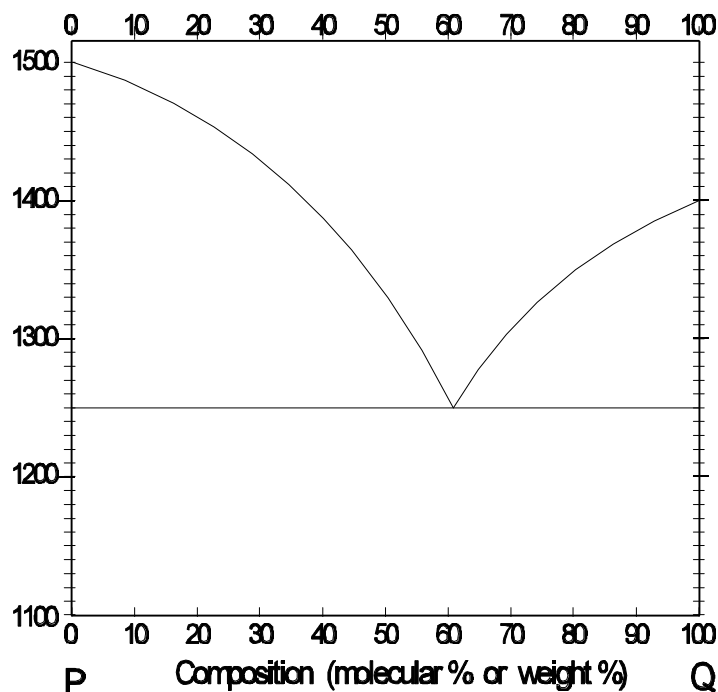


- 65. The temperature the very first crystal will begin melting?  
 [A] 1200 [B] 1220 [C] 1400  
 [D] 1420 [E] 1520
- 66. The composition of the first liquid?  
 [A] 0% Q [B] 5% Q [C] 40% Q  
 [D] 80% Q [E] 95% Q
- 67. The temperature the very last crystal will begin melting?  
 [A] 1200 [B] 1220 [C] 1400  
 [D] 1420 [E] 1520
- 68. "r" [as in  $X_{next}$ ] increases in which direction:
  - a. Toward the lower right.
  - b. Toward the upper right.
  - c. Toward the lower left.
  - d. Toward the upper left.
  - e. None of these.

- 69. TRUE OR FALSE (2 PTS). Under these conditions we would never expect to get pure P or pure Q.

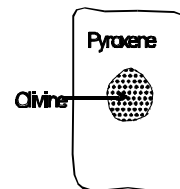
**TRUE OR FALSE: 2 points each, 14 points total:**

To the right is a binary eutectic phase diagram. Beginning with a composition of 20% Q answer the following.



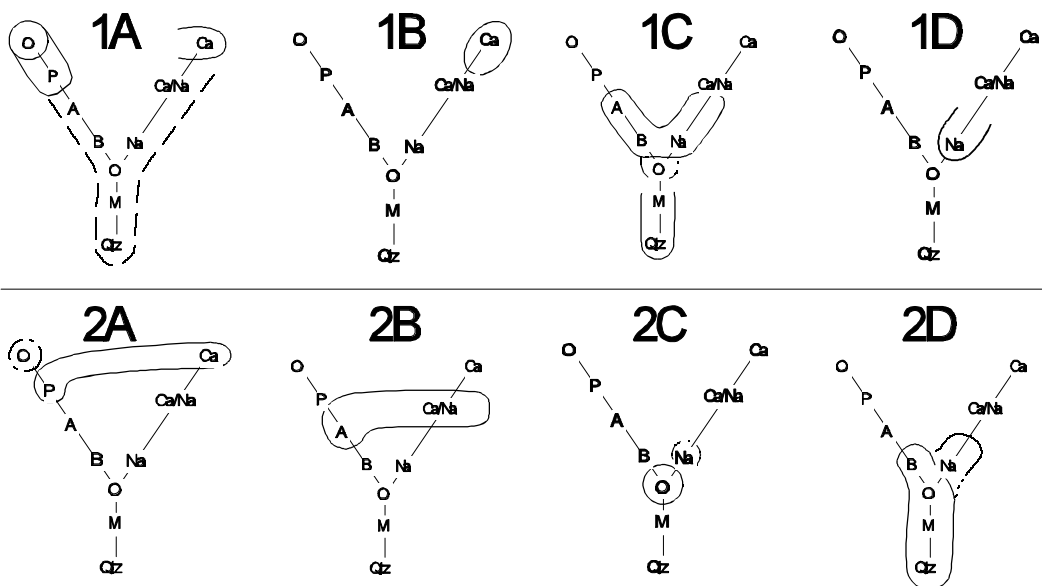
- 70. The temperature the very first crystal will begin melting is at the eutectic point.
- 71. Beginning with 20% Q melt the first crystal(s) will have a composition of 20% Q.

72. The last crystals to come out will be pure P.
73. Fractionation can take place only when the system is at the eutectic point.
74. What percent of Q must melt before P melts alone?  
 [A] 30% [B] 50% [C] 60% [D] 70% [E] 100%
75. **TRUE OR FALSE.** This phase diagram is the best one to explain the relationships in the olivine/pyroxene drawing to the right.
76. **TRUE OR FALSE.** For the drawing to the right. This is an example of Logical Fertility in science.



## BOWEN'S HYPOTHESIS FOR THE EVOLUTION OF IGNEOUS ROCKS

**RIGHTS MINUS WRONGS: MULTIPLE CHOICE: 3 points each, 18 points total:** Below are 8 outline drawing of Bowen's Reaction Series with different sets of minerals circled. Answer the questions about the sequence of igneous rock fractionation and evolution.



**First in fractionation sequence.**

77. 1A, 1B, 1C, 1D, E=none of this row.  
 78. 2A, 2B, 2C, 2D, E=none of this row.

**2<sup>nd</sup> in fractionation sequence.**

79. 1A, 1B, 1C, 1D, E=none of this row.  
 80. 2A, 2B, 2C, 2D, E=none of this row.

**Last in fractionation sequence.**

81. 1A, 1B, 1C, 1D, E=none of this row.  
 82. 2A, 2B, 2C, 2D, E=none of this row.

**MULTIPLE CHOICE: 3 points each, 6 points total:** On the overhead is a diagram “**Fractional Evolution of Igneous Rocks**”. In the questions below you are to identify the rock[s] most likely to be found at various locations on the diagram.

83. Rock C is most likely a:  
 A=Alkaligranite, B=Plagiogranite, C=Diorite/Andesite, D=Gabbro/Basalt, E=Ultramafic
84. Rock G is a:  
 A=Alkaligranite, B=Plagiogranite, C=Diorite/Andesite, D=Gabbro/Basalt, E=Ultramafic

**TRUE/FALSE: 2 points each, 14 points total:** These questions deal with the theoretical principles of attractors and evolutionary processes

85. The last rock in an evolutionary sequence of rocks is both a local attractor and an evolutionary attractor.
86. A local attractor is an open system.
87. Igneous rocks fractionate only if the melting is incomplete.
88. In the Palisades Sill the largest grains are found just above the center because the fractionation process causes crystals to settle toward the bottom.
89. Olivine concentrates in layers at the top and bottom because of the chill zone.
90. Because the highest specific gravity crystals settle out, the lowest density crystals accumulate in a layer near the top.
91. Bowen’s hypothesis for igneous rock evolution failed because Bowen did not understand plate tectonics.

## WHERE IGNEOUS ROCKS ARE FOUND

**RIGHTS MINUS WRONGS MULTIPLE CHOICE; ANSWER ALL THAT APPLY: 3 points each, 24 points total:** Projected on the screen is a drawing of a portion of the earths crust with various locations identified by number. The questions ask you to identify the rocks most likely to be found at these numbered locations.

**Location 1 in Cross Section:** Identify the rock(s) most likely to be found at This Location.

92. A=Alkaligranite, B=Andesite, C=Anorthosite, D=Basalt, E=Diorite.  
 93. A=Dunite, B=Gabbro, C=Peridotite, D=Plagiogranite, E=Rhyolite.

**Location 2 in Cross Section:** Identify the rock(s) most likely to be found at This Location.

94. A=Alkaligranite, B=Andesite, C=Anorthosite, D=Basalt, E=Diorite.  
 95. A=Dunite, B=Gabbro, C=Peridotite, D=Plagiogranite, E=Rhyolite.

**Location 3 in Cross Section:** Identify the rock(s) most likely to be found at This Location.

96. A=Alkaligranite, B=Andesite, C=Anorthosite, D=Basalt, E=Diorite.  
97. A=Dunite, B=Gabbro, C=Peridotite, D=Plagiogranite, E=Rhyolite.

**Location 4 in Cross Section:** Identify the rock(s) most likely to be found at This Location.

98. A=Alkaligranite, B=Andesite, C=Anorthosite, D=Basalt, E=Diorite.  
99. A=Dunite, B=Gabbro, C=Peridotite, D=Plagiogranite, E=Rhyolite.

**Location 5 in Cross Section:** Identify the rock(s) most likely to be found at This Location.

100. A=Alkaligranite, B=Andesite, C=Anorthosite, D=Basalt, E=Diorite.  
101. A=Dunite, B=Gabbro, C=Peridotite, D=Plagiogranite, E=Rhyolite.

**Location 8 in Cross Section:** Identify the rock(s) most likely to be found at This Location.

102. A=Alkaligranite, B=Andesite, C=Anorthosite, D=Basalt, E=Diorite.  
103. A=Dunite, B=Gabbro, C=Peridotite, D=Plagiogranite, E=Rhyolite.

Note that in addition to the material listed in the study guide you may also be asked to identify any of the 8 rock forming minerals, or any igneous rock we examined, or identify any volcano or intrusive igneous body (e.g. sill, dike, etc.). A sample test format for these questions is on the next few pages.

You may review these items at the Igneous Rock web pages listed on the home page under Part Two: The Rock Record - Minerals and Igneous Rocks. Most of the test illustrations will come from the ones on the web pages, but there may be one or two that you have not seen before, but they will be typical examples of the specimen.

They may show up as an overhead projected onto the screen, or I may put them into a PowerPoint presentation and just have the computer cycle through the images endlessly during the test time.

## COMPUTER PROJECTED IDENTIFICATIONS

**RIGHTS MINUS WRONGS: MULTIPLE CHOICE: 3 points each, 33+bonus points total:** BONUS system. Each identification is worth 3 points, plus you get one bonus point for each one you get correct after the first one.

You will be shown a series of illustrations, cycling every 20 seconds. Specimens are numbered on the screen and here. Identify the specimen from the choices in the boxes.

### ROCK FORMING MINERALS

1A Amphibole	2A Plagioclase - Na
1B Biotite	2B Plagioclase - CA
1C Muscovite	2C Pyroxene
1D Olivine	2D Quartz
1E Orthoclase	

### Mineral Specimen 1

**MINERAL:** Identify from Bowen's Reaction Series

104.	1A	1B	1C	1D	1E
105.	2A	2B	2C	2D	

### Mineral Specimen 2

**MINERAL:** Identify from Bowen's Reaction Series

106.	1A	1B	1C	1D	1E
107.	2A	2B	2C	2D	

*Identify the Igneous Rocks Using the choices in the table to the right.*

### Igneous Rock Selections

### Igneous Rock Specimen 1

Identify from slide illustration.

108.	1A	1B	1C	1D	1E
109.	2A	2B	2C	2D	2E
110.	3A	3B	3C	3D	3E

### Igneous Rock Specimen 2

Identify from slide illustration.

111.	1A	1B	1C	1D	1E
112.	2A	2B	2C	2D	2E
113.	3A	3B	3C	3D	3E

**Igneous Rock Specimen 3**

Identify from slide illustration.

114.	1A	1B	1C	1D	1E
115.	2A	2B	2C	2D	2E
116.	3A	3B	3C	3D	3E

**Igneous Rock Specimen 4**

Identify from slide illustration.

117.	1A	1B	1C	1D	1E
118.	2A	2B	2C	2D	2E
119.	3A	3B	3C	3D	3E

**Igneous Rock Specimen 5**

Identify from slide illustration.

120.	1A	1B	1C	1D	1E
121.	2A	2B	2C	2D	2E
122.	3A	3B	3C	3D	3E

**Igneous Rock Specimen 6**

Identify from slide illustration.

123.	1A	1B	1C	1D	1E
124.	2A	2B	2C	2D	2E
125.	3A	3B	3C	3D	3E

**Identify the Volcanos/Lava Flows Using the choices in the table to the right.** BONUS system. Each identification is worth 3 points, plus you get one bonus point for each one you get correct after the first one.

<b>Volcano/Lava Flow Selections</b>
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**Volcano/Lava Flow Identification 1**

Identify from slide illustration.

126.	1A	1B	1C	1D	1E
127.	2A	2B	2C	2D	2E

**Volcano/Lava Flow Identification 2**

Identify from slide illustration.

128.	1A	1B	1C	1D	1E
129.	2A	2B	2C	2D	2E

**Volcano/Lava Flow Identification 3**

Identify from slide illustration.

130.	1A	1B	1C	1D	1E
131.	2A	2B	2C	2D	2E