

Igneous rock classification and partial melting in one lecture

1. Preclass learning journal assignment (one per day, 20% final grade)
2. Learning objectives
3. Preclass concept checkpoint (multiple conceptests* etc.)
4. Lecture part 1
5. Two conceptests
6. Lecture part 2
7. Two short answer interpretation questions
8. Repeat learning objectives

*Conceptests worth ~7% of class grade

Flipped Introductory Class

- Flipped Class Model: Some physical geology instruction presented online before class
 - Students watch a video and complete low stakes online quiz
- Frees ~15 minutes of class for more challenging concepts

Lesson timeline and content before/after introduction of videos

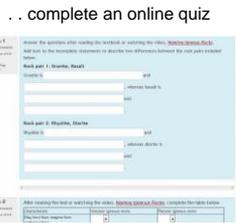


Pre Class Assignment

Students view brief videos as preclass assignments then . . .



Videos begin with learning objectives, often contain formative assessments, and end with a reflection activity



... complete an online quiz
Average completion time ~30 minutes

Present learning objectives for today's lesson

MEA 101: Module 3: Learning Journal 2 Learning Objectives

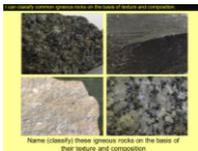
- I can explain how the texture and composition of volcanic and plutonic igneous rocks vary
- I can give examples of volcanic and plutonic rocks that formed from felsic, mafic and intermediate magmas.

MEA 101: Module 3, Part 2 Class Learning Objectives

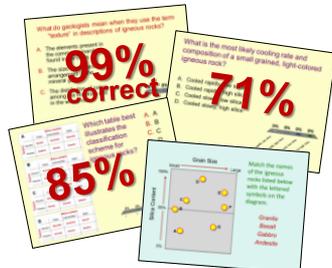
- I can describe how mafic magma differs from felsic magma.
- I can explain the three principal mechanisms for melting rocks.
- I can define the term, partial melting.
- I can explain how different types of magma form in association with the following plate settings:
 - oceanic ridge, subduction zone, hot spot, rift valley.

Beginning of lesson

- Answer ~6 video review questions



Name classify these igneous rocks on the basis of their texture and composition



Students work in small informal groups to answer several conceptests and two conceptual (interpretation) questions

What is the most likely cooling rate and composition of a small grained, light-colored igneous rock?

- A. Cooled rapidly, low silica
- B. Cooled rapidly, high silica
- C. Cooled slowly, low silica
- D. Cooled slowly, high silica

		Silica content		
		Felsic	Intermediate	Mafic
Texture	Volcanic	Basalt	Andesite	Rhyolite
	Plutonic	Gabbro	Diorite	Granite

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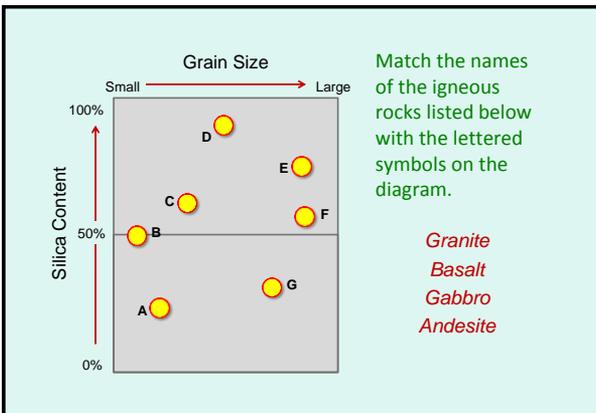
Which table best illustrates the classification scheme for igneous rocks?

- A. A
- B. B
- C. C
- D. D

I can classify common igneous rocks on the basis of texture and composition.

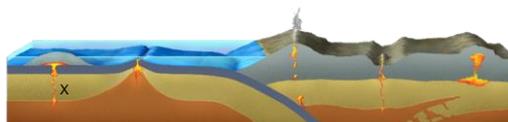


Name (classify) these igneous rocks on the basis of their texture and composition



Lecture sequence

- Present slides to define partial melting, discuss three partial melting processes
- Ask two conceptests that ask students to predict melting process at various plate boundaries (exploration)



Magma at X forms as a result of which process?

Lecture sequence

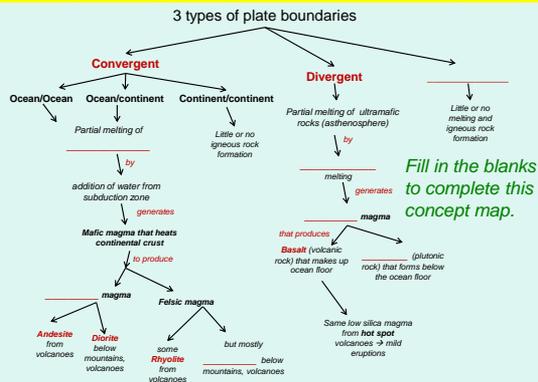
- Present slides that discuss specific details of partial melting at divergent and convergent plate boundaries
- Students complete two questions that require them to place the process of partial melting in the context of plate tectonics and relate it to igneous rock type

Use the cross-section below to identify the causes of partial melting at each location (1-5) and label where the igneous rocks listed below could be found



Andesite – Basalt – Diorite – Gabbro – Granite – Peridotite – Rhyolite

LO: I can explain how magmas and igneous rocks form in association with plate settings



Present learning objectives for today's lesson

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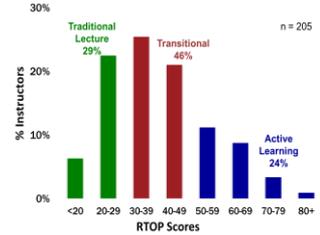
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MEASURING TEACHING PRACTICE

Reformed Teaching Observation Protocol¹

- Maximum score = 100
- Reformed classrooms featuring more active learning practices have higher RTOP scores



Classroom Observation Project
205 instructors/classes
Average RTOP score = 39.7

¹Sawada et al., 2002; Martiñac and Falconer, 2002; Budd et al., 2013

OBSERVED TEACHING PRACTICES

	Most Traditional Lecture n=10	Mean Traditional Lecture n=10	Mean Transitional Lecture n=22	Mean Active Learning n=12	Most Active Learning n=11
No/few questions asked by instructor	50%	27%	0%	0%	0%
No/few questions from students	60%	36%	9%	0%	0%
Students are passive/not asked to do anything	70%	36%	4%	0%	0%
No student-student interaction/conversation	70%	80%	32%	0%	0%
Student-student interactions or group work	0%	9%	59%	100%	91%
Students read graphs, maps, use data	20%	27%	27%	67%	45%
Students answer open-ended questions	0%	0%	4%	17%	45%
Instructor assesses students (new or prior knowledge)	10%	18%	18%	33%	45%
Lesson adjustments based on student work or prior knowledge	0%	0%	9%	33%	54%

Active Learning Options – Degree of Difficulty

