

## Course Syllabus

### Title

Understanding Heat Transfer

### Target Audience

This course is intended for pre-service and in-service teachers of physical science in grades 5-8.

### Prerequisites

To successfully participate and complete the assignments in this course, the learner must:

- Be familiar with taking an online course or have completed the PBS “Practice Learning Online with TeacherLine” course.
- Have some experience in grades K-12 classrooms.
- Have an interest in life, earth and space sciences.

### Course Description

This course focuses on three elements: content knowledge, inquiry and other teaching strategies, and use of multimedia and visualization tools in teaching and learning about heat transfer. This course advances understanding and effective teaching about radiation, conduction, and convection and how heat influences density. Through the readings, videos, discussions, assignments, and other interactive experiences, learners in this course will have multiple opportunities to develop content knowledge about mechanisms of heat transfer and formative assessment using what students know about heat transfer to improve instruction. Learners will experience a rich multimedia, inquiry-based learning environment as their students ideally would in their own classrooms. The course provides effective teaching methodologies, strategies and tools that can be used when teaching physical science concepts.

### Instructor/Facilitator

See instructor/facilitator sheet.

### Credits

To be determined by college or university.

### Course Goals

As a result of participating in this course learners will:

- Understand radiation, convection, and conduction;
- Understand how heat transfer affects density; and
- Examine the use of formative evaluation when teaching these topics.

### Outline of Content and Assignments

Learners in this course are expected to participate in discussions and complete assignments. Learners are also expected to keep a personal notebook (which is not assessed) to keep notes, complete exercises and record reflections about their learning experiences in this course.

### Discussion Activities

- **Essential Question** – Each session includes a discussion about an essential question and teaching and learning issues related to this question. Learners post responses to questions posed in the course and respond to posts submitted by their colleagues.

**Assignments** - Learners are expected to submit assignments. Rubrics are provided for assessment of all assignments, and the course content includes assignment samples.

Assignments in this course include:

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- **Questions: Compare Your Answer** - Learner's written responses to a question are compared to answers written by experts in the field.
- **Writing Assignments** - Short writing assignments (essays) are submitted to the facilitator.

### Required Readings

- "Energy, Heat and Temperature"
- "How Thermoses (Vacuum Flasks) Work"
- "Teaching Science: Forming Inquiring Minds"
- "Considering the Possibilities"
- "Formative Assessment Probes: Uncovering Students' Ideas in Science"
- "Classroom Assessment for Learning"
- "A Strategy for Excellent Teaching"
- "Considering the Possibilities"
- "Teaching Standard C"

## SESSION 1: MECHANISMS OF HEAT TRANSFER

**Objectives** - After completing this session, learners will be able to:

- Define different ways in which energy is transferred between material as heat;
- Explain how convection and conduction influence density;
- Transfer their knowledge about convection and conduction to real-world examples; and
- Connect heat transfer concepts to their classroom practices.

Using an inquiry-based approach, the session is divided into the following sections: Invitation, Exploration, Explanation, Application and Putting It into Practice. The **Essential Question** for this session is: ***How does energy transfer from one substance to another as heat, and how does this affect these substances?***

Activities in this session delve into the nature of light and sound waves and their technology application. Learners investigate mechanisms of heat transfer, including radiation, convection, and conduction, and explore how heat transfer affects the density of a substance.

Assignments in this session require learners to explain the aspects of everyday insulators, to test different insulators and to describe how heat transfers by convection,

Discussions in this session focus on finding solutions for the essential question for this session.

Learners will record notes and reflections in their personal notebook about different concepts, methods, activities and ideas presented throughout the session.

## SESSION 2: FORMATIVE ASSESSMENT

**Objectives** - After completing this session, learners will be able to:

- Articulate their ideas regarding the effectiveness of various models of teaching;
- Develop strategies to pinpoint students' prior conceptions and misconceptions in science;
- Give examples of formative assessment strategies; and
- Analyze teaching models for their effectiveness in assessing inaccurate prior conceptions.

Using an inquiry-based approach, the session is divided into the following sections: Invitation, Exploration, Explanation, Application and Putting It into Practice. The **Essential Question** for this session is: ***How does what students already know when they come to class affect what they learn?***



Activities in this session will delve into the heat transfer in the context of how to use what students already know to plan instruction that improves students understanding.

Assignments in this session require learners to create a formative assessment script and describe how formative assessment strategies impact classroom situations. Learners also revise a lesson plan on heat transfer to incorporate the ideas, activities, and resources from the course.

Discussions in this session focus on finding solutions for the essential question for this session.

Learners will record notes and reflections in their personal notebook about different concepts, methods, activities and ideas presented throughout the session.

### **Schedule**

This course is scheduled to take approximately 30 hours to complete.

### **Requirements**

Learners are expected to:

- Complete all assignments.
- Participate and actively engage in discussions with fellow learners while contributing to the social construction of knowledge.
- Be self-directed and self-motivated.
- Ask for assistance when they need it.

Facilitators are expected to:

- Provide feedback to all learners.
- Participate in discussions to keep them moving forward.
- Provide assistance to learners who need it.

### **Technical Requirements**

- Word Processor
- Internet service provider
- E-mail
- Shockwave and Flash: <http://www.macromedia.com/downloads/>
- Acrobat Reader: <http://www.adobe.com/products/acrobat/readstep.html>
- QuickTime: <http://www.apple.com/quicktime/download/>

### **Standards of Academic Integrity**

As posted on PBS TeacherLine Web site at  
[http://teacherline.pbs.org/teacherline/help/help\\_template3.cfm?subID=197](http://teacherline.pbs.org/teacherline/help/help_template3.cfm?subID=197)

### **Evaluation**

This course is evaluated on a letter grade basis, and graduate credit may be available. See the PBS TeacherLine Web site for details pertaining to specific graduate credit instructions.

Last Update: August 22, 2007