

1. Oil is spilled onto the water from an oceangoing tanker. Investigators want to know whether wave motion will help disperse the oil. Design an experiment that they can carry out in a laboratory to find out whether wave motion will help disperse the oil. Describe the equipment they should use and the procedure they should follow.

Equipment:

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Procedure:

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## Scoring Guide

### Score & Description

#### Complete

Student response outlines a suitable method and includes a control.

#### Essential

Student response outlines a suitable method but fails to mention a control.

#### Partial

Student response contains aspects of a correct experiment but fails to follow it through or has correct equipment with minimal but correct methodology.

#### Unsatisfactory/Incorrect

Student response describes no experiment or an inaccurate experiment.

### Complete - Student Response

- 1 Oil is spilled onto the water from an oceangoing tanker. Investigators want to know whether wave motion will help disperse the oil. Design an experiment that they can carry out in a laboratory to find out whether wave motion will help disperse the oil. Describe the equipment they should use and the procedure they should follow.

Equipment:

Two tubs of water; Ball that bobs in the water from a motor; and oil.

Procedure:

Take two tubs of water pour oil in one corner of each. In one of them bob the ball, creating waves. See in which one does the oil spread more.

- 1 Oil is spilled onto the water from an oceangoing tanker. Investigators want to know whether wave motion will help disperse the oil. Design an experiment that they can carry out in a laboratory to find out whether wave motion will help disperse the oil. Describe the equipment they should use and the procedure they should follow.

Equipment:

2 Large pools of water, oil, wave maker

Procedure:

① Fill the pools with water ② Put the "spilled" oil in both pools ③ Make artificial waves in one pool ④ See if the waves helped to disperse the oil

Scorer Comments:

Both responses provide descriptions of suitable equipment and a complete method for finding out whether wave motion will help disperse oil.

#### Essential - Student Response

- 1 Oil is spilled onto the water from an oceangoing tanker. Investigators want to know whether wave motion will help disperse the oil. Design an experiment that they can carry out in a laboratory to find out whether wave motion will help disperse the oil. Describe the equipment they should use and the procedure they should follow.

Equipment:

Wave machine

Fish tank

Vegetable oil

Procedure:

Create an "oil slick" in the fish tank, and set the wave machine up in the tank, creating waves. Make observations as to whether the slick breaks up and disperses throughout the tank, or remains together.

- 1 Oil is spilled onto the water from an oceangoing tanker. Investigators want to know whether wave motion will help disperse the oil. Design an experiment that they can carry out in a laboratory to find out whether wave motion will help disperse the oil. Describe the equipment they should use and the procedure they should follow.

Equipment:

Water, swimming pool, oil, some kind of measurement tool, boat

Procedure:

2<sup>o</sup> fill the swimming pool with water and dump the oil into it, 2<sup>nd</sup> Take a raft and push it up & down so that it makes waves. 3<sup>rd</sup> calculate how far the oil move, if any.

Scorer Comments:

Both responses provide descriptions of suitable equipment and a method that only lacks a control.

#### Partial - Student Response

- 1 Oil is spilled onto the water from an oceangoing tanker. Investigators want to know whether wave motion will help disperse the oil. Design an experiment that they can carry out in a laboratory to find out whether wave motion will help disperse the oil. Describe the equipment they should use and the procedure they should follow.

Equipment:

Food coloring  
Water  
Plastic tub. 10" x 40" x 8"  
Wave maker

Procedure:

Food coloring  
Water  
Plastic tub. 10" x 40" x 8"  
Wave maker

The tub should be filled with water. The food color should then be added all together to simulate a spill. Artificial waves should then be used to check the oil to see if dispersion has occurred.

- 1 Oil is spilled onto the water from an oceangoing tanker. Investigators want to know whether wave motion will help disperse the oil. Design an experiment that they can carry out in a laboratory to find out whether wave motion will help disperse the oil. Describe the equipment they should use and the procedure they should follow.

Equipment:

large bowl  
water  
oil (cooking oil) or (black oil)

Procedure:

In a large bowl filled with water pour some of the oil in one area (enough so it can spread). Then with a gentle rocking motion, move the bowl to see if the oil disperses.

Scorer Comments:

The first response contains some aspects of a correct experiment, but uses food coloring instead of oil and lacks a control. The second response describes the correct equipment, but the method is minimal and lacks a control.

#### Unsatisfactory/Incorrect - Student Response

- 1 Oil is spilled onto the water from an oceangoing tanker. Investigators want to know whether wave motion will help disperse the oil. Design an experiment that they can carry out in a laboratory to find out whether wave motion will help disperse the oil. Describe the equipment they should use and the procedure they should follow.

Equipment:

They should use a big wave machine to help disperse the oil throughout the water.

Procedure:

They should have 4 different wave machines that will push the waves in 4 different directions causing the oil to more easily disperse in the ocean water.

- 1 Oil is spilled onto the water from an oceangoing tanker. Investigators want to know whether wave motion will help disperse the oil. Design an experiment that they can carry out in a laboratory to find out whether wave motion will help disperse the oil. Describe the equipment they should use and the procedure they should follow.

Equipment:

They should use a machine that measures  
how much oil there is in the water.

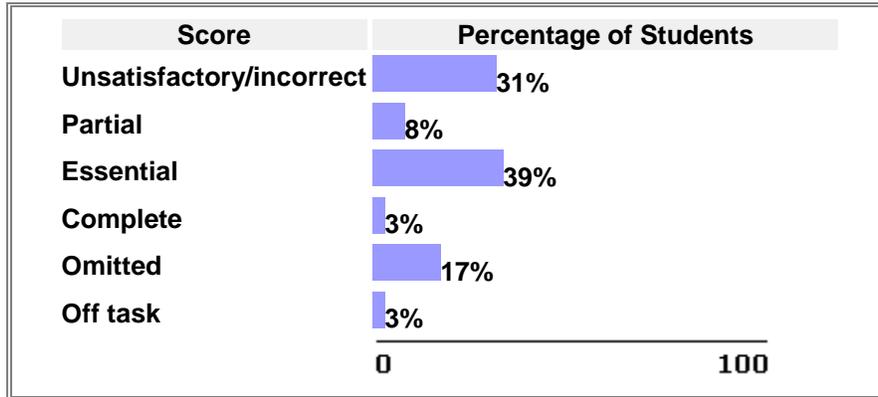
Procedure:

You could put the machine in the water  
after you clean up as much as possible,  
then you test to see if the oil is  
spreading.

Scorer Comments:

The first response does not describe an experiment, and the second response does not offer any component of a correct experiment.

### 2005 National Performance Results



Note:

- These results are for public and nonpublic school students.
- Percentages may not add to 100 due to rounding.

**The Fields of Science:** *Earth & Space Sciences* (Sub content classification: *Water*)  
**Knowing and Doing Science :** *Scientific Investigation*

## **The Fields of Science**

### ***Earth & Space Sciences***

This question measures basic knowledge and understanding of the following:

#### **Water**

- water cycle;
- nature of the oceans and their effects on water and climate; and
- location of water, its distribution, characteristics, and effect of and influence on human activity.

## **Knowing and Doing Science**

### ***Scientific Investigation***

Scientific investigation probes students' abilities to use the tools of science, including both cognitive and laboratory tools. Students should be able to acquire new information, plan appropriate investigations, use a variety of scientific tools, and communicate the results of their investigations.