
Particular



CONCEPTS

PK - Elementary

SANDBOX PARTICULATE PHYSICS ACTIVITIES

SAND BOXERS - EXPLORERS

PRE SCHOOL -- KINDERGARTEN -- 6TH GRADE

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CONTENTS

Introduction:		<i>i</i>
Outline of Activities:		<i>iii</i>
Standards :		<i>vi</i>
A Seventh Simple Machine?		<i>vii</i>
<hr/>		
Activity 1:	"Particular" Engine	1.0
"The Sand Train"	PK-2cnd	
Sand Boxers move things with ONLY sand!		
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Activity 2:	"Particular" Valve	2.0
"The Holey Towers"	PK-2cnd	
Sand Boxers control sand with towers FULL of holes!		
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Activity 3:	"Particular" Golf	3.0
"Marble Run"	2cnd-3rd	
Sand Boxers move a marble up hill for a hole-in-one!		
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Activity 4:	"Particular" Invisible Forces	4.0
"Piling it On 1-2-3"	3rd-6th	
Explorers discover the invisible active Forces of particulates.		
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Activity 5:	"Particular" Direction	5.0
"Moving Walls"	3rd-6th	
Explorers use moving walls to efficiently direct the motive Force of particulates		
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Activity 6:	"Particular" Competition	6.0
"Milk Carton Run"	3rd-6th	
Explorers compete to come up with the fastest milk carton.		
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****Videos are available by going to particularconcepts.com, and clicking on the activity.**

Note: Brooms, Dustpans and/or a large canister vacuum cleaner are highly recommended for ALLLLLLL activities (for clearing up)!

Outline of Activities

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Overview

The Particular Concepts manual and its accompanying videos foster inductive reasoning at all ages. Introducing new, inductively derived principles, the activities extrapolate actual observations and known formulas. These "discoveries" were not deducted from generalized theories. Every activity is tied to ordinary materials, and each activity progressively and inductively takes you from one observable event to the next.

A particulate agglomerate is made up of incompressible particles, which interact only by friction. A particulate becomes a simple machine when piled against a vertical surface: the vertical force of gravity on the particles of the agglomerate is transmitted, by a general wedging action among the particles, to become a combined horizontal force.

William Rankine quantified the Passive Particulate Force, The result is a unique "angle-of-repose". Civil engineers throughout the world use Rankine's formulas to build retaining walls to stabilize the passive force of these materials. The Spry patents extrapolate and apply Rankine's discovery of this internal friction interaction. The "engine", "valve", and "retaining wall" concepts use Rankine's observations to produce these predictable applications. For the bulk of this manual, "Spry" refers to these patented principles: inductive extrapolations of Rankine's well-reasoned revelations. "Particular" is a new term, referring to the properties – or the application of the properties – of Rankine-like particulates.

Particular Concepts stems from a simple *inductive* query: What does an ordinary pile of dry sand reveal through reasonable thought, observation, and manipulation?

Elementary Activities (Sandboxers to Explorers): **Activities 1, 2 and 4** are core to all the other activities. They demonstrate the uniformity of the motive ("Sand Train") and retentive ("Holey Towers") Forces, and are the first introductions to these new physics applications. *It is important to note that both the motive and retentive Force develop uniformly with the depth and mass of the uniform particulate.* **Activity 5** shows how a particulate Force can be precisely directed. **Activity 6** is an up scaling of activities 1, 4 and 5, for older students.

Outline of Activities

Overview Continued

Secondary Activities (Engineers, Philosophers, and Wizards): Activities 7 through 12 progressively introduce traditional physics principles: coefficient of friction, angle-of-repose, density, the Rankine Passive Force, the Rankine Active Force, center-of-gravity, turning groove, inclined plane, etc. **Activity 11** **Activity 12** is the combination of these traditional principles with the patented principles, culminating in a compound machine that can, for example, move and erect large granite obelisks. **Activity 13** is an opportunity to discuss the nature of discovery, through suggested readings, essays, and journal entries. For further study, a "Suggested Study List: A Short Time-Line of Inductive Scientists" is also included at the end of the Secondary - Adult Manual.

Outline of Activities

Elementary

Activity 1: "Particular" Engine "The Sand Train" PK-2cnd

By demonstrating the differences between two materials that both flow -- but do not both pile (water vs. sand) -- Sand Boxers observe the difference in the **internal friction** of two materials. They also observe that the natural **angle-of-repose**-- caused by the internal friction of particulates-- prevents the downward gravitational Forces on any particle from flowing like water. This internal friction "stops" the flow.

With the introduction of the cup, the Sand Boxers find out what happens when the natural angle-of-repose is interrupted by an obstruction. This is an application of the Rankine Active Motive Force that constantly alters within the particulate until it again reaches its natural angle-of-repose. If this force is "interrupted", it operates against the interruption, until the particulate can again reach its ordinary angle-of-repose, and the cup moves.

Activity 2: "Particular" Valve "Holey Towers" PK - 2cnd

By noting, reconfiguring, and repeating the difference between the "Holey Towers" holes and "Particular" Valves, Sand Boxers actively observe the following "Particular" points:

- When a particulate pile of incompressible particles is interrupted by a wall -- with the upper portion of the valve deep enough to allow the pile to reach its natural angle-of-repose -- all of the valves fill with particulate, but none comes through.
- A particulate pile -- that is interrupted with holes without the upper portion deep enough to qualify as a "stopping" valve -- continues to flow out of the holes, and does not reach its natural angle-of-repose within the confines of the valve.
- Within the pile, the increment of force at various heights within a pile of dry sand is constant. That is: *it is independent of whether the valve is near the bottom or near the top of tower.* Each valve is retaining the
- same force of particulate. If the force difference was **not** constant (a difference between the bottom and top of the "tower"), the bottom valve would push the particulate further out than the top valve. As the tower grows, the particulate in the valves does not change. It remains constant as long as the valves (and the particulates) are constant. This is an important principle. By repeating the "Holey Tower" activity for taller and taller towers the same independence is consistently observed, no matter the depth. Only changes in the characteristics of the particulate results in changes in the performance of the valves.
- By removing particulate from the Spry Valve* -- that holds back the particulate in the tower -- Sand Boxers can precisely control the movement of an object downwards. (as in the Abisur Graves.)

Outline of Activities

*Elementary
continued*

Activity 3: "Particular" Golf
"Marble Run" 2nd-3rd

This is simply a variation of **Activity 1**, suitable for older students.

Activity 4: "Particular" Invisible Forces
"Piling it On 1-2-3" 3rd-6th

A merging of **Activities 1** and **2**, minus the imaginative "train" or "tower. This classic demonstration clearly shows the "invisible" active Forces contained in a pile of uniform particulate material are always equal and opposite:

- In part one, the interior particulate force moves the doweled horizontal boards underneath the pile. The particulate force causes the two support boards to separate, demonstrating a horizontal force.
- In part two the anchored vertical wall shows that the Rankine Active Motive (Spry*) Force causes the movement of the wall away from the pile. This particulate Force causes the two support boards to separate
- In part three, the anchored wall demonstrates the equal, reactive Rankine Active Retentive (Spry**) Particulate Force by moving the pile of sand away from the wall.
- The final outcome of this activity is: For every action, there is an equal and opposite reaction.

Do not confuse the "reaction" force discussed here with the particulate "passive" force developed in Rankine's original paper. Instructors or students interested in such complete formulation are referred to recent Civil Engineering texts (ie. Braja M. Das, Advanced Soil Mechanics, Second Edition, California State University)

Activity 5: "Particular" Direction
"Moving Walls" 3rd-6th

This activity shows how the particulate motive force can be directed with efficient precision,.

Activity 6: "Particular" Competition
"Milk Carton Run" 3rd-6th

This is a repeat of Activity 1, Procedure 3, scaled up for the benefit of older, abler students.

With a higher back to the milk carton, it also expands Activity 3: the larger the surface area that the particulate can push against, the larger the motive force. It further incorporates Activity 4 by using the moveable walls in the contest. Not only does it increase the height of the particulate more quickly, it keeps the particulate efficiently confined.