

FINAL

3/01/2006

Activity 13: Skateboard School

game_forceinmotion.swf

Grades 3-6

I. Key concepts

- How does force affect movement
- What's the impact of balanced/unbalanced forces on an object in motion
- What's the difference between stored (potential) energy and energy of motion (kinetic)
- How can movement be described (speed, velocity, acceleration)

II. Main Activity

external fact ref.: <http://www.exploratorium.edu/skateboarding/>

(Ollie-oop ref.) http://www.ehow.com/how_4809_ollie-skateboard.html

(class_intro.wav) Welcome to Skateboard School. I'm Walter Wheelie. My teaching assistant Sal is here to kick things off! Choose a lesson:

(Clicking a lesson plays lesson .wav)

- (anatomy.wav) Skateboard Anatomy
- (halfpipe.wav) Half-pipe Power
- (ollieoop.wav) Ollie-oop!

Skateboard Anatomy (wheel/bearings image ref. http://www.skatewarehouse.com/skateology.html)	Half-pipe Power (power ref. g4, p. 417) See mockup end of document.	Ollie-oop! A balancing act! (fact ref. g5, p. 410; g6, p. 417) "Photos" described below can be perceived as still frames in an animation. Photos can build in pile to show progression of ollie.
(class1_00.wav) A skateboard is more than wood and wheels! [Build it!] (fade in deck) (class1_01.wav) For starters, Sal doesn't want her feet to slip on the board. So she covers the deck with sandpaper (add dotted texture to deck). The bumpy surface creates friction between the board and her feet. Friction is a force that stops Sal's	(Sal is rolling up and down ramp in looped animation. Sal automatically pumps slightly, reaching 75% ramp height.) (class2_00.wav) Energy is the ability to do work. Work is the ability to move something. Sal needs energy to move up and down the ramp. [Next] (class2_01.wav)	(class3_00.wav) Different forces can push and pull an object at the same time. If these forces are balanced , an object can keep moving at the same speed and direction. (photo 1a: animated loop of Sal being pulled by big dog. Moving at consistent speed) When forces are unbalanced , an object changes speed or direction.

feet from **moving**.

(ref. g4, p. 445)

[Add wheels]

(class1_02.wav)

To move the **skateboard**, Sal uses special wheels to **reduce friction**. The wheels are attached to an axle. When the axle turns, the wheels move. (if necessary, zoom in on wheel/or show wheel callout) **Ball bearings** are sandwiched between the wheel and the axle (show like an xray, as these are not exposed).

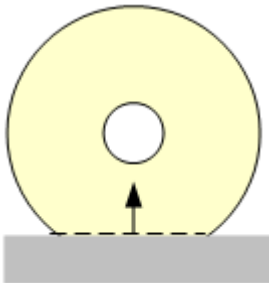
The ball bearings stop the wheel and axle from rubbing against each other. If there is less rubbing, there is less friction. The wheels don't slow down as fast.

[Add skateboarder]

(add feet to board. We only need to see ankle down, so we still have close-up on wheels. Wheels should flatten on bottom from Sal's weight. Roll wheels. Skateboard should appear to be moving.)

(class1_03.wav)

The wheels are made of a special rubber called urethane. Sal's weight flattens the wheels into the ground. Just like a ball, the wheel wants to pop back into shape. The wheel pushes against the ground, helping move the board forward.



[Replay]

Sal can **gain** energy at the bottom of the ramp by **pumping** her legs. Just like on a swing, you gain energy by bending your legs, then stretching them out. (fact ref. g4, p. 448. Insert [Pump] button. If user clicks pump, Sal will pump more, making her reach top of ramp. Pump = 1x. Note that speed and acceleration values change when Sal is pumped.)

[Next]

(class2_02.wav)

(Add kinetic/potential energy gauge.)

As Sal rides **up** the ramp, **energy of motion** changes to **stored energy**.

On the way down, stored energy changes back to energy of motion.

Why is stored energy greatest at the top of the ramp?

[Tell me!]

(class2_03.wav)

When Sal **stops**, she is **not** using energy of motion.

(Bottom animation. Like Food Chain, may be played independently from above.)

[Play]

(class2_04.wav)

Motion can be described by **speed**, **velocity**, and **acceleration**.

Speed describes **how fast** Sal moves in a certain amount of time.

Velocity describes Sal's speed **and** direction.

Acceleration is a **change** in **speed** or **direction**. Sal accelerates when she speeds up, slows down, or turns.

(photo 1b: Sal loses leash and rolls to a stop.)

[Ollie]

(class3_01.wav)

(photo 2: kick tail of board down. nose points up.)

Sal pushes the back of her board **down** into the ground. The ground pushes **up** allowing Sal to jump.

[Next]

(photo 3: mid air jump. skateboard appears to be stuck to Sal's feet. Board is parallel to ground.)

(class3_02.wav)

Sal straightens out the board with her front foot. In the air, the force **pushing up** is equal to the force **pulling down**. When forces are **balanced**, Sal and her skateboard move in the same speed and direction.

[Next]

(class3_03.wav)


(show photo 4: Sal and board are still parallel to ground. But they have dropped.)

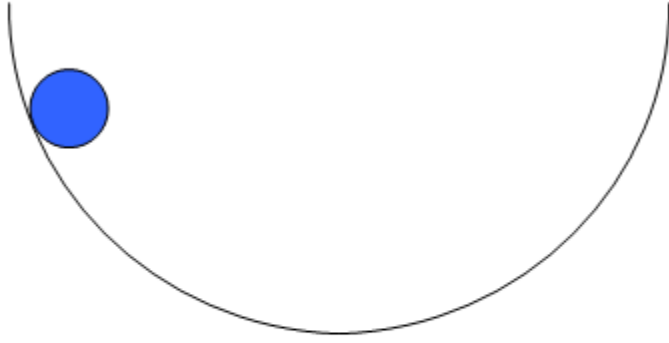
Gravity, the force pulling down, eventually gets **stronger** than the force pushing up. When forces are **unbalanced**, Sal's speed and direction change.

[Replay]

Class 2: Half-pipe Power

Energy







stored energy (potential)

energy of motion (kinetic)

pump

play	<p>Speed</p>  <p>slow fast</p> <p>km/hour</p>	<p>Velocity is speed and direction</p>  <p>slow fast</p> <p>km/hour</p>	<div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">up</div> <div style="border: 1px solid black; padding: 2px; background-color: pink;">down</div>	<p>Acceleration</p> <p>Sal accelerates each time her speed or direction changes.</p>
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Automatically update Speed/Velocity values to match animation:

Not pumped:

- Up = 1
- Down = 3

Pumped:

- Up = 2
- Down = 4