WIGGLE-BOT OVERVIEW

TeacherGeek

ENGINEERING NOTEBOOK

Design # **1**

TeacherGeek

Name(s): Susie Q

Project: Wiggle-Bot Racer

ASK

What is the problem (what needs to be solved/made better)?

Make a fast Wiggle-Bot to win the race

DESIGN PROCESS

ASK → IMAGINE → PLAN → CREATE → IMPROVE → (cycle)

Research: How have others solved, or a___ problem? What are the constraints ___ this ___ not, or must, do or be)?

My wiggle-bot h___ the track. Others have added ___ ___ station of components. I wa___ ___ to wi___

IMAGINE

Brainstorm, sketch and describe possi___ (that might solve the problem). Use exi___ ent ideas ___eded.

mean team

double gears

Choose the best solution. Circle it. Why do you think it is best?

This design is lighter. I think it will go faster.

CONTINUE TO "PLAN"
on page 2

PAGE 1

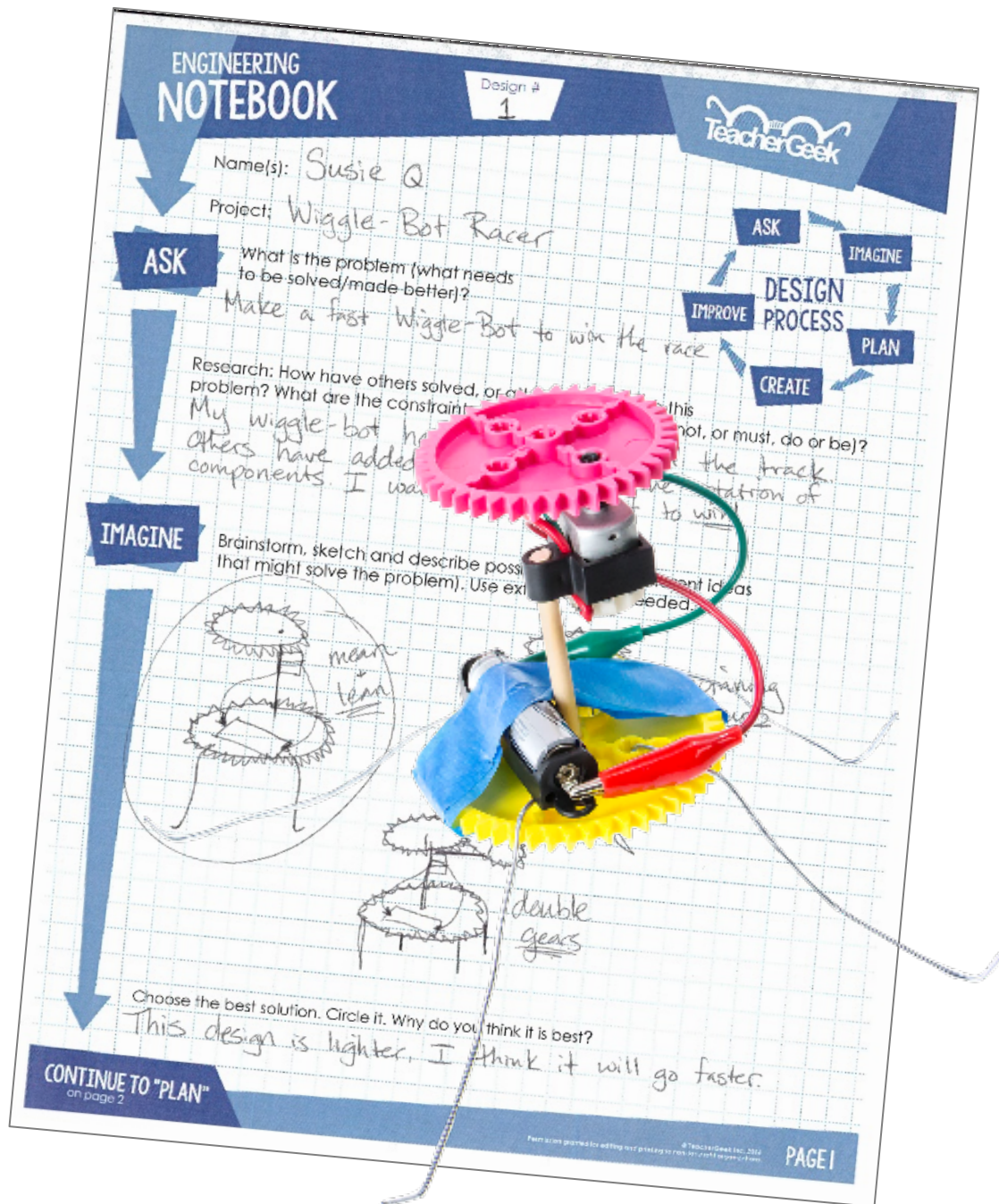
💡 **THINKING AHEAD**
Will you build a scribble bot, a racing bot, or invent a new kind of bot all your own?

Download Documents and get your supplies at **teachergeek.com**
Single: *SKU 1823-16*, 10 pack: *SKU 1824-56*

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Everyone loves to wiggle!

Recommended Age Level:
Activity Age Level:
Lab Age Level: 8-13, Grades 3-8
Recommended Group Size: 1-3 Students/Wiggle-Bot

Note: This overview is intended for classroom use. For out of the classroom documents & guides, check out **teachergeek.com/learn**.
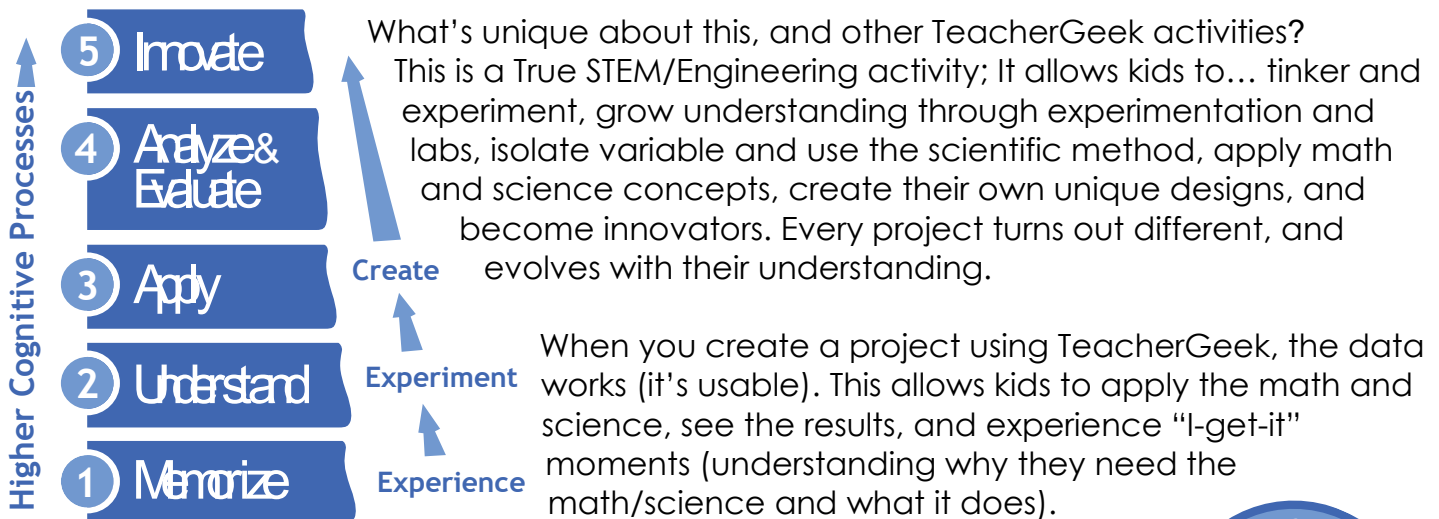
OVERVIEW

Scribble, race, dance, paddle… These are some of the amazing things Wiggle-Bots can be designed to do. These contraptions are powered by a motor, and students' imaginations.

Evolve Wiggle-Bots through experimentation (tinkering). Appreciate the challenge of going beyond step-by-step instructions and creating something completely new (innovating). It's an incredible experience.

Optional Wiggle-Bot Labs teach about electricity and wavelengths. An optional Challenge turns Wiggle-Bots into racer-bots.

Higher Cognitive Processes

- 5 Innovate
- 4 Analyze & Evaluate
- 3 Apply
- 2 Understand
- 1 Memorize

Create
Experiment
Experience

Adapted from Bloom's Taxonomy

What's unique about this, and other TeacherGeek activities? This is a True STEM/Engineering activity; It allows kids to… tinker and experiment, grow understanding through experimentation and labs, isolate variable and use the scientific method, apply math and science concepts, create their own unique designs, and become innovators. Every project turns out different, and evolves with their understanding.

When you create a project using TeacherGeek, the data works (it's usable). This allows kids to apply the math and science, see the results, and experience "I-get-it" moments (understanding why they need the math/science and what it does).

Make It Your Own: The documents for this activity are available in PDF and Microsoft Word format. If you wish to edit a document, simply download the Microsoft Word format.

STEM TRUE STEAM

STANDARDS

Aligned to Next Generation Science Standards:

Grade 4

Energy

- **4-PS3-1** Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- **4-PS3-2** Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- **4-PS3-4** Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Waves and their Applications in Technologies for Information Transfer

- **4-PS4-1** Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

Engineering Design

- **3-5-ETS1-2** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- **3-5-ETS1-3** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Grade 5

Engineering Design

- **3-5-ETS1-2** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- **3-5-ETS1-3** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Grades 6-8

Engineering Design

- **MS-ETS1-1** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **MS-ETS1-2** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-3** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- **MS-ETS1-4** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
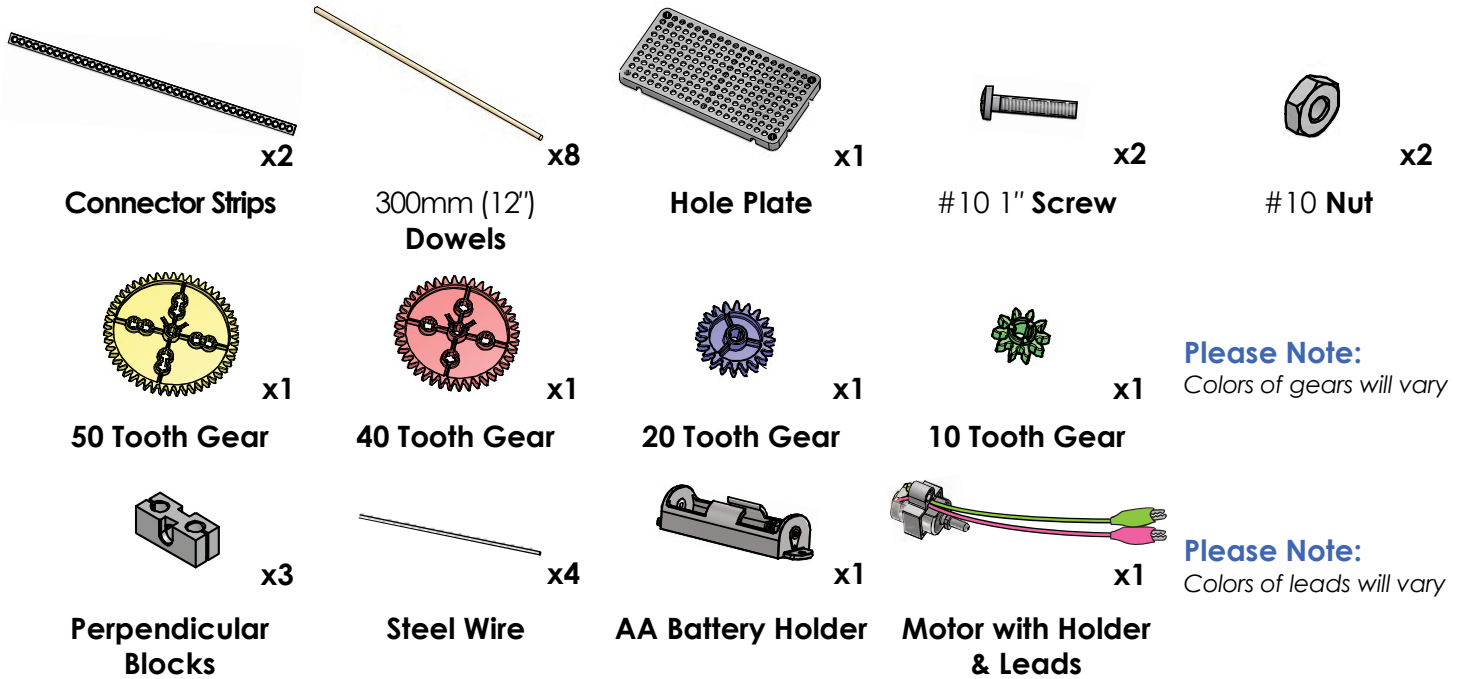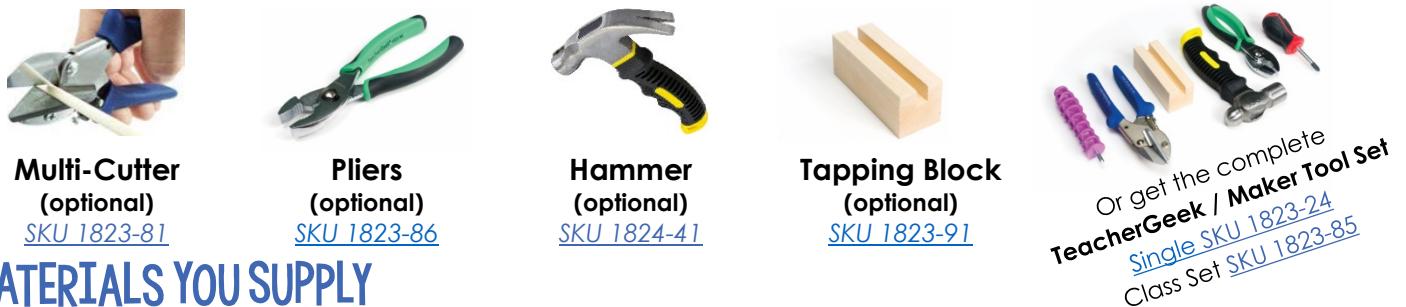

TEACHERGEEK COMPONENTS

Below is the list of "ingredients" you'll need for each **Super Wiggle-Bot**.

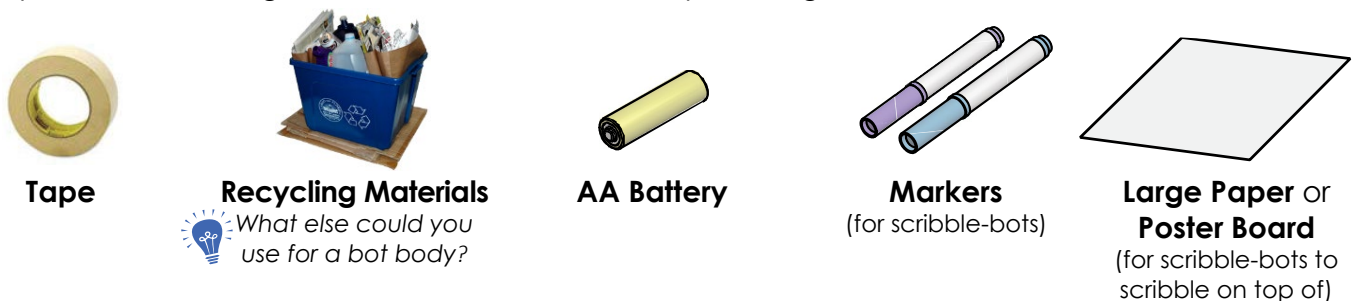*Available as single: SKU 1823-16 or 10 pack: SKU 1824-56. Both include extra parts for your own innovative creations!*

x2	**x8**	**x1**	**x2**	**x2**
Connector Strips	300mm (12") **Dowels**	**Hole Plate**	#10 1" **Screw**	#10 **Nut**

x1	**x1**	**x1**	**x1**	**Please Note:**
50 Tooth Gear	**40 Tooth Gear**	**20 Tooth Gear**	**10 Tooth Gear**	*Colors of gears will vary*

x3	**x4**	**x1**	**x1**	**Please Note:**
Perpendicular Blocks	**Steel Wire**	**AA Battery Holder**	**Motor with Holder & Leads**	*Colors of leads will vary*

TEACHERGEEK TOOLS   *Perfect for sharing in groups of 3 and 4!*

Time to break out those tools and start building! Remember to be kind and share with others.

Multi-Cutter (optional) SKU 1823-81	**Pliers** (optional) SKU 1823-86	**Hammer** (optional) SKU 1824-41	**Tapping Block** (optional) SKU 1823-91	*Or get the complete* **TeacherGeek / Maker Tool Set** Single SKU 1823-24 Class Set SKU 1823-85

MATERIALS YOU SUPPLY

Go on your own scavenger hunt to find these items. Try building with all kinds of materials!

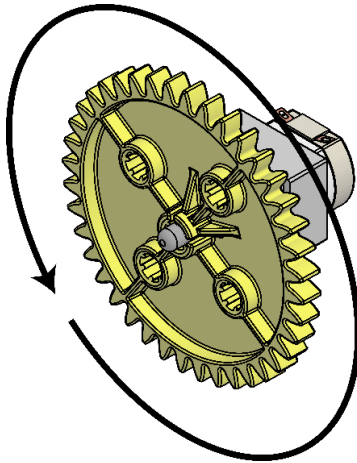|				
Tape	**Recycling Materials** *What else could you use for a bot body?*	**AA Battery**	**Markers** (for scribble-bots)	**Large Paper** or **Poster Board** (for scribble-bots to scribble on top of)

BACKGROUND

Vibrate... Vibrate... your cell phone is set to "silent" mode, and a call is coming in. *What's inside your phone making it vibrate?*

It's time to brush your teeth. You turn on your electric toothbrush. It too vibrates. *What makes your toothbrush vibrate?*
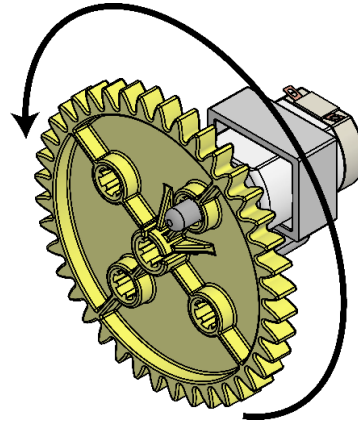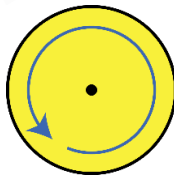
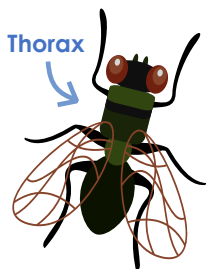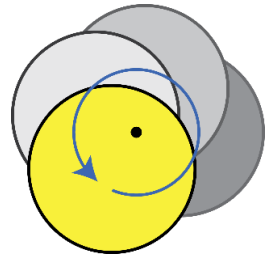Answer: Phones and toothbrushes vibrate using a motor with a *non-concentric* weight.

On left: motors with *non-concentric* weights

*A motor with a **concentric** weight spins fast and smooth*

A motor with a non-concentric weight vibrates (bounces) when it spins.

Thorax

Some flies vibrate, to fly

Flies can beat their winds up to 1000 beats per second. How do they do it? Not with muscles - they vibrate their **thorax**, which is attached to their wing base. This vibration caused the wings to beat up and down at an incredible speed.

The concepts above may be important when trying to make Wiggle-Bots wiggle.
Not all Wiggle-Bots vibrate. Some roll, hop, flip, or even paddle.

RESOURCES

There are "a ton" of resources to help you complete this activity. Pick and choose the ones that will work for you. They available as links below, or at **teachergeek.com/learn**.

Wiggle-Bot Documents
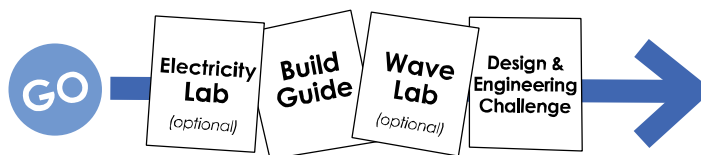
- Overview—This is it (you're reading it).
- Build Guide and Labs—Grades 3-8 (Required)
    - **Super Wiggle-Bot Build Guide**
        - During this step you will make a working Wiggle-Bot. Change it to a Scribble-Bot, Racing-Bot, or a new kind of Bot.
    - **Electricity Lab**—Optional
        - Students will use some Wiggle-Bot components before they build to investigate electricity, circuitry, atoms and what they're made of.
    - **Wiggle-Bot Wave Lab**—Optional
        - Students investigate how electricity travels in wavelengths; they will explore frequency and amplitude.
- Wiggle-Bot Engineering Challenge
    - Speedway (Racing-Bot Races)
- Engineering Notebook Pages

Wiggle-Bot Videos

- Example Wiggle-Bot Build #1- Youtube Video
- Example Wiggle-Bot Build #2- Youtube Video
- Wiggle-Bot's in Classroom- Youtube Video

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PROCEDURE

There are many optional Labs for Wiggle-Bots, download them with the In the Classroom Build Guide as part of the Build Guide and Labs packet. You get to choose which Labs (if any) you would like to do. After you've finished, you can download the Wiggle-Bot Engineering Challenge and Engineering Notebook sheets to take your designs to the next level. Documents are available as links below or at **teachergeek.com/learn**.
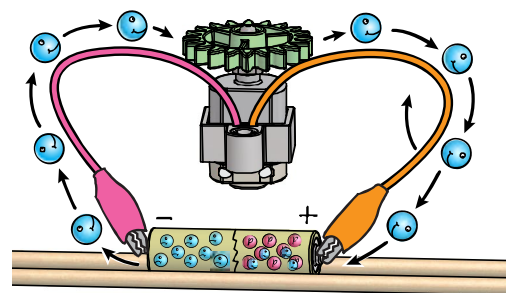
GO → Electricity Lab (optional) → Build Guide → Wave Lab (optional) → Design & Engineering Challenge →

1 Electricity Lab — Optional

This Lab allows students experiment with electricity; discovering atoms and learning how it relates to voltage and electrical currents.

This Lab uses Wiggle-Bot components and works best if completed before Wiggle-Bots are first built.

Download the Wiggle-Bot Build Guide and Labs

2 Build Guide — Required

This is where Wiggle-Bots come to life. Students will tinker and experiment, growing their understanding as they evolve their Wiggle-Bot. Wiggle-Bots should continue to evolve. Students can be challenged to come up with as many different designs (ways for their wiggle bot to move or scribble) as possible. Encourage them to name their designs.

If you want students to make their Wiggle-Bot's scribble, you will want to lay out large paper sheets where they Wiggle-Bots will draw. They will also need markers and tape.

Download the Wiggle-Bot Build Guide and Labs

3

Wave Lab — Optional

This is a fun, unique, and meaningful way to teach about waves. Students will create Wiggle-Bots that draw waveforms. When they alter their Wiggle-Bot designs, their waveform attributes will change (period, frequency, amplitude, etc.) Students will identify these attributes and engineer their Wiggle-Bots to perform them.

Download the Wiggle-Bot Build Guide and Labs

4

Wiggle-Bot Racer, Engineering Challenge — Optional

The challenge is simple: design and build a Wiggle-Bot to go as fast as possible and win races. Compete against the clock or other Wiggle-Bots.

Download the Wiggle-Bot Racer Challenge Document to learn more.

It's an Engineering Challenge; immersing students in the Engineering Design Process. Learn more about the Design Process on the next page.
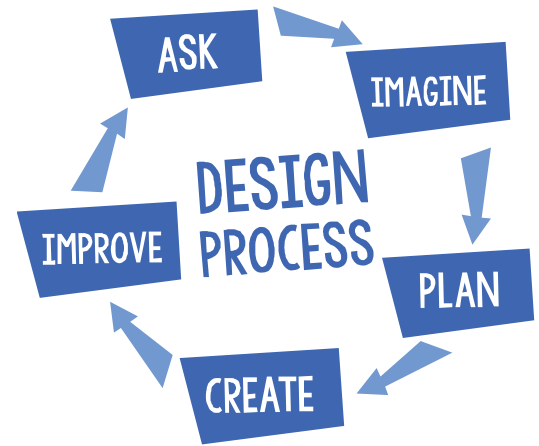
Track Setup

- Find a flat, smooth and level surface in your room. It could be the floor or a table top.

- Use two or more meter sticks to form racetrack lanes. Tape the sticks down at the start and the finish, to make 15cm (6in) racetrack lanes.

- Meter sticks can be put end-to-end to form longer race tracks.

- Mark the start and finish lines with tape.

Download the Wiggle-Bot Engineering Challenge

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THE ENGINEERING DESIGN PROCESS

Do you have a challenge to solve? Is there something you want to invent, fix or improve? You do? Excellent… the Engineering Design Process is exactly what you need.

Inventing, fixing, improving… these are really ways to create a solution to a problem. A problem can be as complicated as creating a way to live on Mars, or as simple as stopping a door from squeaking. You are reading this because you have a problem to solve; to create the fastest Wiggle-Bot. The Design Process will help you solve it. Here's how it works…

ASK → IMAGINE → PLAN → CREATE → IMPROVE → (ASK)
DESIGN PROCESS

ASK

What is the problem (what needs to be solved/made better)?

The Design Process helps you solve a problem. This is why you need to start the Design Process by identifying a problem. In this activity, your first problem it to create a Wiggle-Bot that will move the fastest down the race track.

After constructing your first Wiggle-Bot and completing one time around the Design Process, your problem may change. Your next problem might be to make the Wiggle-Bot move forwards and faster, or keep from tipping over.

There is no perfect design, so there is no end to the Design Process. You can always identify a new problem (a way to make your Wiggle-Bot better) and go around the Design Process again.

Research: How have others solved, or attempted to solve this problem?

If you are going to solve the problem, you better know what you are doing. After identifying the problem, take a look at how others have solved, or tried to solve it. Look around your class, search the library and internet, ask other people.

What are the constraints (things your design cannot, or must, do or be)?

It would be great if you could solve this problem any way you want, with anything you want. The truth is… you can't. You have these things called "constraints" which limit what your design can do, can't do, must be, or can't be (How confusing is that?). Constraints could be resources like time or materials. They could also be rules, such as how big the racer can be, or what powers it. You need to identify the constraints to your problem.

IMAGINE

Brainstorm, sketch and describe possible solutions (different ideas that might solve the problem).

This is a fun part. You can brainstorm, or use another process, to come up with as many possible solutions to your problem as possible. Consider your problem, constraints and research while generating possible solutions. Do not judge, or pick, your best solution at this point. Just write as many down as you can. Note: wacky/very unique ideas sometimes lead to wonderful new design solutions. Be super creative, and original.

Choose the best solution. Circle it. Why do you think it is best?

Ok… now it's time to judge. Pick what you think will be the best solution to your problem. Make sure it fits the constraints. It's ok to feel sorry for all of the possible solutions that didn't get picked. They were good ideas too…

PLAN

Draw the solution you choose. Include the details you will need to create it.

Neatly sketch the design you choose (the one you are going to build). The sketch should include details and descriptions about how it will work, or be built.

CREATE

Build the solution you planned.

Is this the step you have been waiting for? You finally get to build the solution to your problem (the new design). Have fun! Take the time to make it properly.

Test it.

Test your solution (new design). How does it work? Does it go really fast down the track? Make small adjustments to optimize it (to try and make this design solution work best).

Make observations. Record results.

Pay close attention while testing your solution. Write down what happened (it tipped over, went backwards, spun, traveled the track in ___ seconds). You will use this information to make your Wiggle-Bot even better.

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IMPROVE

Did you solve the problem?

Take a look at the test results. Reflect on your observations. Did your solution solve the problem as you had planned?

Yes? Great! Identify a new problem (a way to make your design even better).
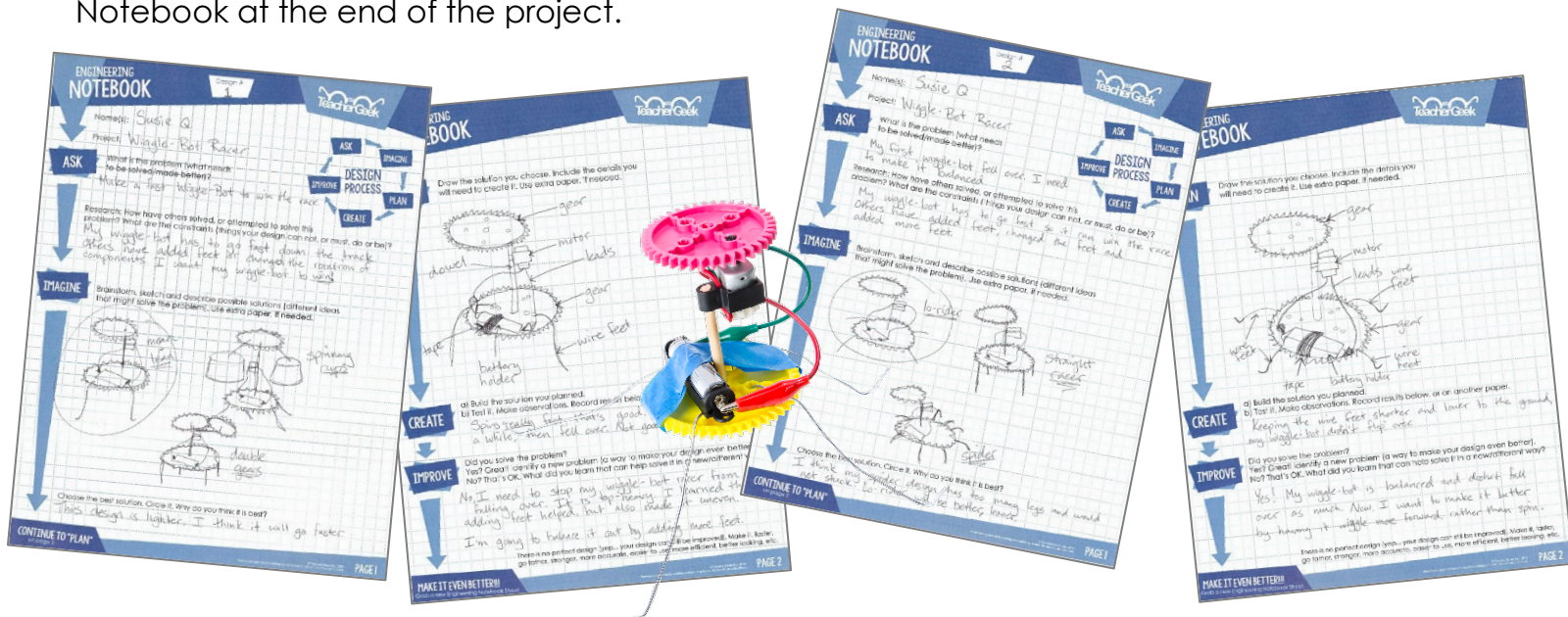
There is no perfect design (yep... your design can still be improved). Identify another problem that will make your Wiggle-Bot a better racer. Grab another Engineering Notebook Sheet and try to solve it.

No? That's OK. What did you learn that can help solve it in a new/different way?

You learn more from failures than you do from successes. The best solutions come from/after failures (ideas that didn't work). Most inventions do not work the first time around the Design Process. Learn from what didn't work. Grab another Engineering Notebook Sheet and try to solve the problem a different way.

ENGINEERING NOTEBOOK

Fill in a TeacherGeek Engineering Notebook Sheet (front and back) every time you go around the Design Process. Keep your Notebook Sheets. Assemble them into an Engineering Notebook at the end of the project.

Question: Do you need to fill out a new Engineering Notebook Sheet for small changes or tweaks to an existing design? Nope... just record what you did on the current Notebook Sheet.