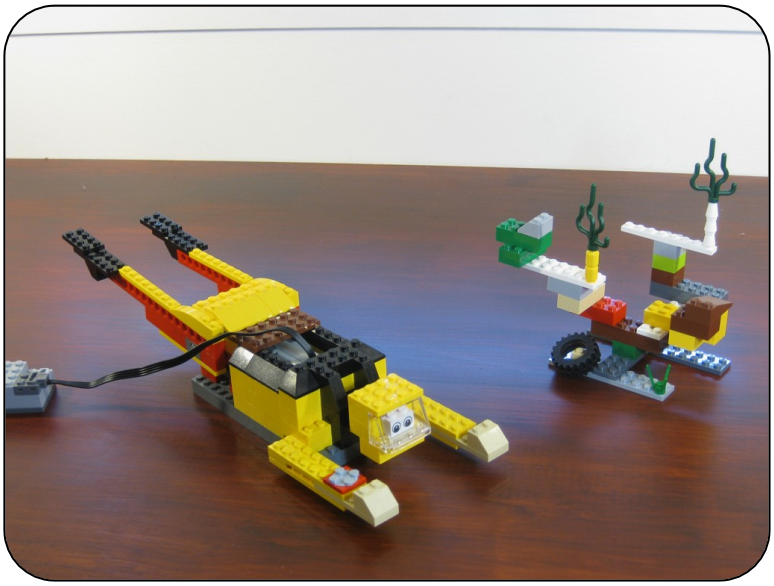
Classroom Activities for the Busy Teacher:
WeDo and LEGO Animal Set
Exploring our Coral Reefs



By Damien Kee and Fay Rhodes

A collection of integrated activities utilizing the WeDo (#9580) and LEGO Animal (#9334) sets

Exploring our Coral Reefs:
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About the Authors

Dr Damien Kee holds a PhD in Robotics and a Bachelor of Electrical Engineering. He has been heavily involved with the RoboCup Junior competition since 2001, and In 2009 he was elected Chairman of RoboCup Junior Australia, and Technical Chair of the RoboCup Junior International Rescue Committee. Since 2003, Damien has been conducting robotics workshops for teachers, educators, students all over Australia and Internationally and is the author of the popular "Classroom Activities for the Busy Teacher" series of teacher resource books.

Damien is a member of the LEGO MINDSTORMS Community Partners, a group who consult with LEGO to make the MINDSTORMS system a better product. He also contributes to the popular theNXTstep Blog http://thenxtstep.blogspot.com

Fay Rhodes B.S. in Education and is the author of three books of NXT animal robot designs—The LEGO MINDSTORMS NXT Zoo!, Robots Alive!-Endangered Species, and NXT One-Kit Creatures. She also has contributed to the LEGO MINDSTORMS NXT Idea Book with other members of the NXT Step Blog.

As a member of the MINDSTORMS Community Partners, she has joined with other NXT enthusiasts around the world to assist and advise the MINDSTORMS division at LEGO. You will also find two of her designs included in the ten free NXT 2.0 designs posted on the LEGO website.

Table of Contents

Introduction *1*

LEGO 4 C's Approach **3**

Classroom management **4**

Connect: Setting the Scene *5*

Research Assignment **5**

Create: Build it! *6*

Creative Writing Assignment **8**

Contemplate: What have we learned? *9*

Continue: What Next? *9*

Student Worksheet *10*

Building Instructions – Scuba Diver *11*

Building Instructions Tropical Fish *26*

Building Instructions Manta Ray *32*

Building Instructions - Sea Turtle *40*

WeDo Backgrounds and Sounds *49*

Story Board *51*

Coral Reef Vocabulary *52*

Standards relating to this Unit *54*

Introduction

This book gives students the opportunity to explore the theme of Coral Reefs. It provides fun and engaging activities, designed to put into context the plight facing coral reefs around the world.

This book assumes that the teacher has some prior knowledge of the WeDo system. If necessary, we highly recommend working through the tutorials that are available on the WeDo software package to bring you up to speed with the programming environment.

This book uses the WeDo LEGO Education set #9580 and the LEGO Animals Set #9334 for the construction of the models. Teachers are highly encouraged to make use of other materials, (craft paper, material, straws etc) to further enhance their students' creations.

LEGO WeDo Set #9580

LEGO Animal Set #9334

LEGO 4 C's Approach

The structure of this book follows LEGO Educations 4C's, an underlying method of teaching that is embedded into all products and curriculum that they produce. The 4C's are as follows:

Connect: The connect phase is an important foundation for students, providing them with the means of connecting existing knowledge to the new idea's being presented. This ability to make personal connections to the activity, gives them greater ownership of the learning, as they can see how it relates to ideas that are meaningful to themselves. The connect phase is also important in providing a solid justification for the inevitable - 'Why are we doing this?'

Construct: Once the context has been given, the Construct phase enables students to design and build their own solutions to the challenges given. These solutions to be constructed may take on many forms, such as a LEGO model, a multimedia presentation, or a written assignment. As a physical object is put together, so too do students link together various pieces of knowledge.

Contemplate: With construction complete (or at least well underway!), students now turn to the Contemplate phase. This gives them a chance to reflect on what was done and what was learned from the exercise. Students discuss their different solutions; modify, adapt and redesign certain parts to both increase effectiveness as well as deepen their understanding. Teachers are encouraged to ask questions and prompt students to present their knowledge to other students.

Continue: The final phase, Continue, encourages the students to ask "What now?" Extension ideas, opportunities for deeper research into specific topics and the opportunity to teach others are all strongly encouraged. These topics can go on to begin new discoveries where the 4C approach is repeated.

Classroom management

Working with LEGO can be a noisy and often chaotic experience, which is not necessarily a bad outcome, and can often spur along creative minds and promote 'out-of-the-box' solutions. If possible, set your classroom up to have a dedicated area for construction activities. Place tables together or let them work on the floor. They will need the space!

Ideas to inspire your students—

- Show interesting video productions, such as the IMax film, *Coral Reef* or the Disney animated feature, *Finding Nemo*.
- Take a field trip to an aquarium
- Decorate the room with big posters on related themes
- Provide creative materials, such as colorful paper, yarn, straws, foil, etc., for students to use in the process of creation.
- Plan a display of the children's work through photos of the children's models (with their own captions) or of the actual creations.

You may wonder—

"How much time should we spend on an activity?"

There is no simple answer to this question: it all depends on the children's developmental level and their interest in the particular project. Teachers often tell us that, thanks to the character driven creative stories, the meaningful process and the discovery involved, activities last longer than traditional learning exercises.

Connect: Setting the Scene

Coral reefs are beautiful, but fragile ecosystems that are home to an amazing variety of marine life. Coral reefs occupy less than 0.1% of the world's ocean surface yet account for a quarter of the marine species currently identified.

Research Assignment

Below are listed several questions that may serve as the basis of a research project. It is up to the individual teacher how in depth the students perform their research but it is important that students become familiar with the issues surrounding Coral Reefs. Teachers may choose several topics together or let students decide which issues interest them the most.

What are Coral Reefs?
- What are they made of?
- What animals / plants live in Coral Reefs?

How are they formed?
- What is the coral forming process?
- How long do they take to form?

Where can they be found?
- What climate conditions are necessary?
- What geographical conditions are necessary?

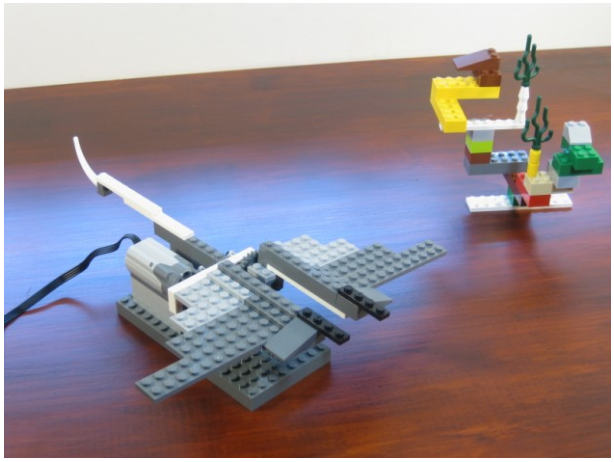
Why are they important?
- Why are they important for biodiversity?
- Why are they important for coastline protection?
- Why are they important for tourism?

Present your findings to the class in the form of a poster, multimedia presentation, speech, newsletter article or another method of your choosing. Some projects can be put on display in public areas to inform other students in your school or the greater community (such as at the public library).

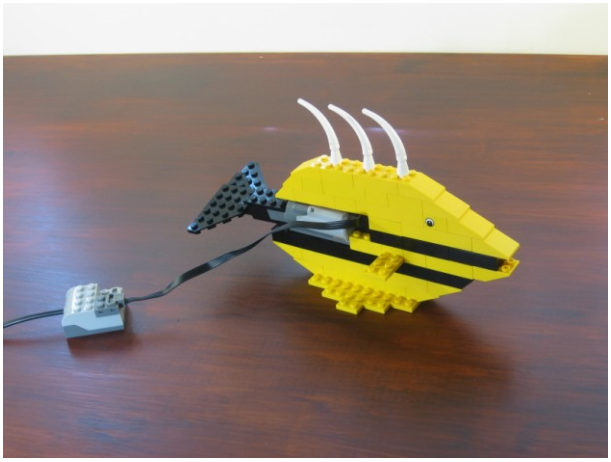
Create: Build it!

Build one or more of the models shown below. Using other materials, decorate and turn your designs into more lifelike creations. For inspiration, have students collect photos of marine creatures from the Internet or the library.

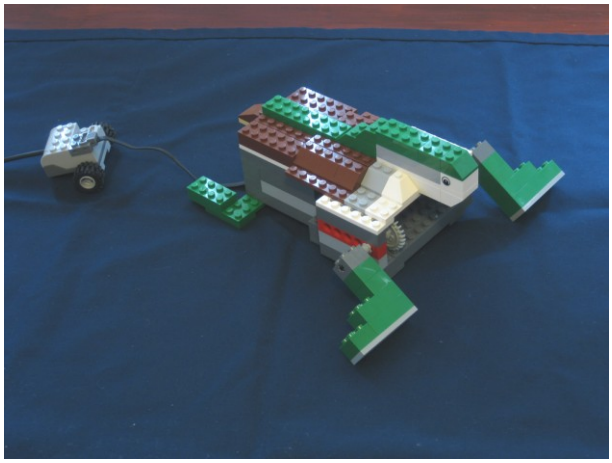
Scuba Diver



Manta Ray



Fish



Sea Turtle

Full building instructions as well as notes about to program each creation can be found at the back of this book.

Coral

Use the leftover pieces of LEGO to create some colorful coral creations. Have a look at pictures of Coral from pictures and movies to gain inspiration.

*Clockwise from top-left: photos by Toby Hudson, Richard Ling, Mikhail Rogov, Richard Ling

More Creative Commons images available from:
http://commons.wikimedia.org/

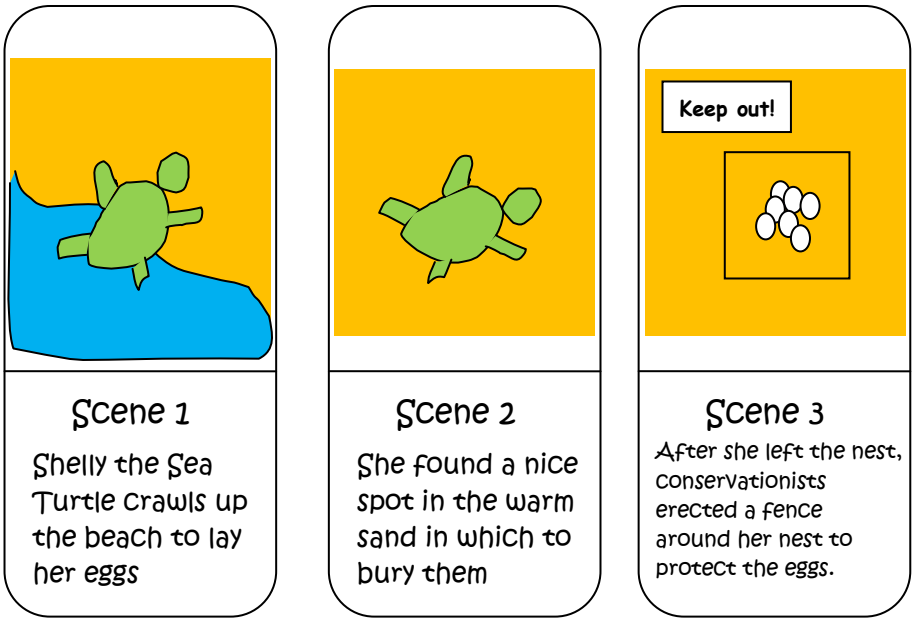
Creative Writing Assignment

Complete a Creative writing activity to complement your creation.
Suggestions could include the following

- Write an imaginative story about a creature or creatures inhabiting or visiting a coral reef.
- Collect pictures and names of many fish found in coral reefs. Have students write a creative story about "How the _____(fishname) Got Its Name".
- Write a news account of an event involving a sea turtle, such as a rescue or an effort to protect the nest of sea turtle eggs.

Once a story has been written, consider turning it into a short movie. Use the Storyboard template at the back of the book to plan out how the story will unfold.

Example:



Contemplate: What have we learned?

Having completed the Connect and Construct phase, students have brought together a large amount of information about Coral Reefs. The Contemplate phase of the LEGO 4C approach now asks the students to use this knowledge to draw new conclusions. The following assignment / discussion topics may help prompt this discussion.

- How do Coral Reefs affect me? Indirectly?
- What do you think would happen if Coral Reefs disappeared?
- Why is there such diversity in marine life within Coral Reefs?
- What is Coral Bleaching?
- How do humans affect Coral Reefs?
- What is being done to protect and revive Coral Reefs?
- What are some good ways of spreading the message about Coral Reefs?

Continue: What Next?

Find an organization that is currently working with Coral Reefs. Ask them what can be done to help their activities.

- What can you do as an individual?
- What can your community do to help?
- What could be done on a global scale?

Any of the questions posed in the Connect section could also be used to drive more in-depth learning.

Student Worksheet

Choose an issue that relates to Coral Reefs. Think of a question that needs to be answered and write it here:

_____

Discover 5 important facts that help answer the question and write a few brief sentences about them.

Important point 1:

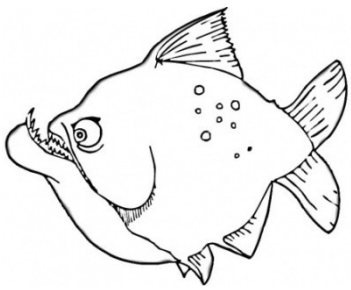
Important point 2:

Important point 3:

Important point 4:

Important point 5:

Using this worksheet as a reference, create a presentation about your topic. It may be a poster, report, multi-media Presentation, speech, ...



Building Instructions – Scuba Diver

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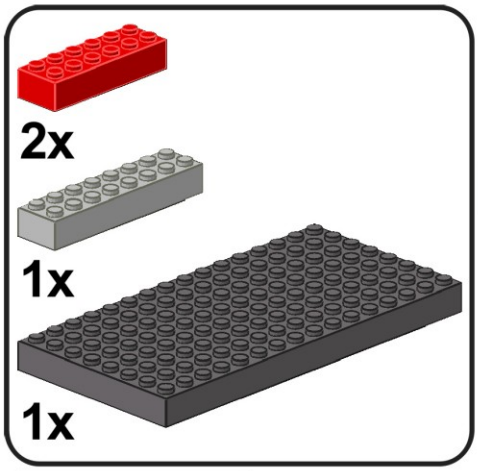

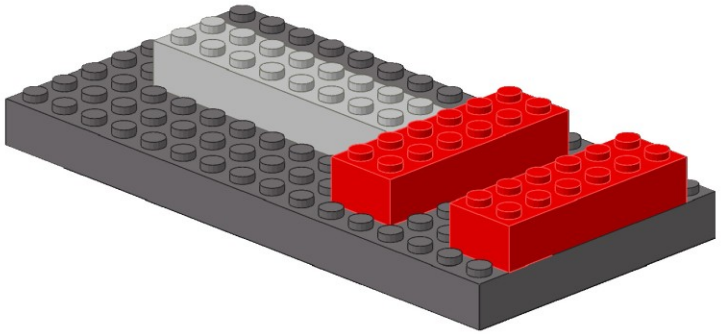

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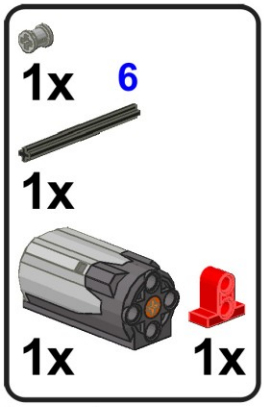

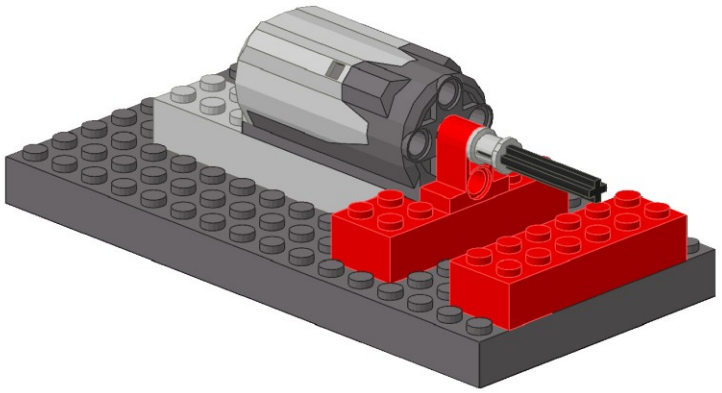

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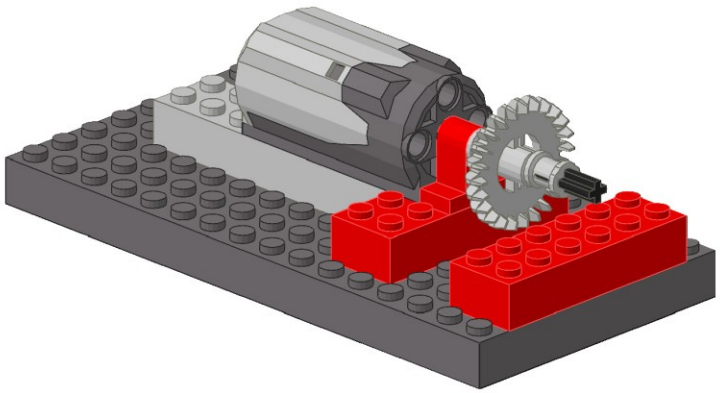

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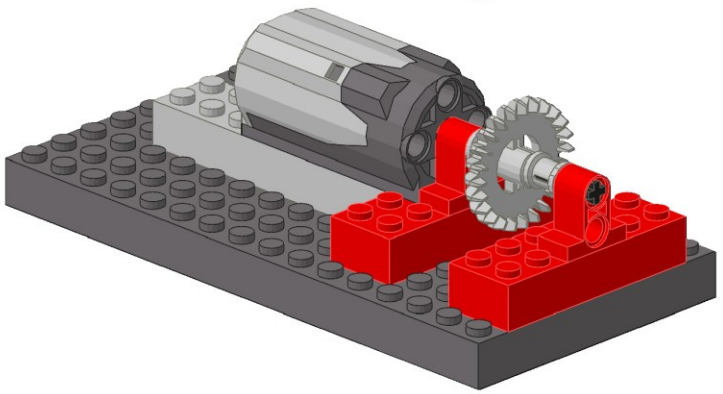

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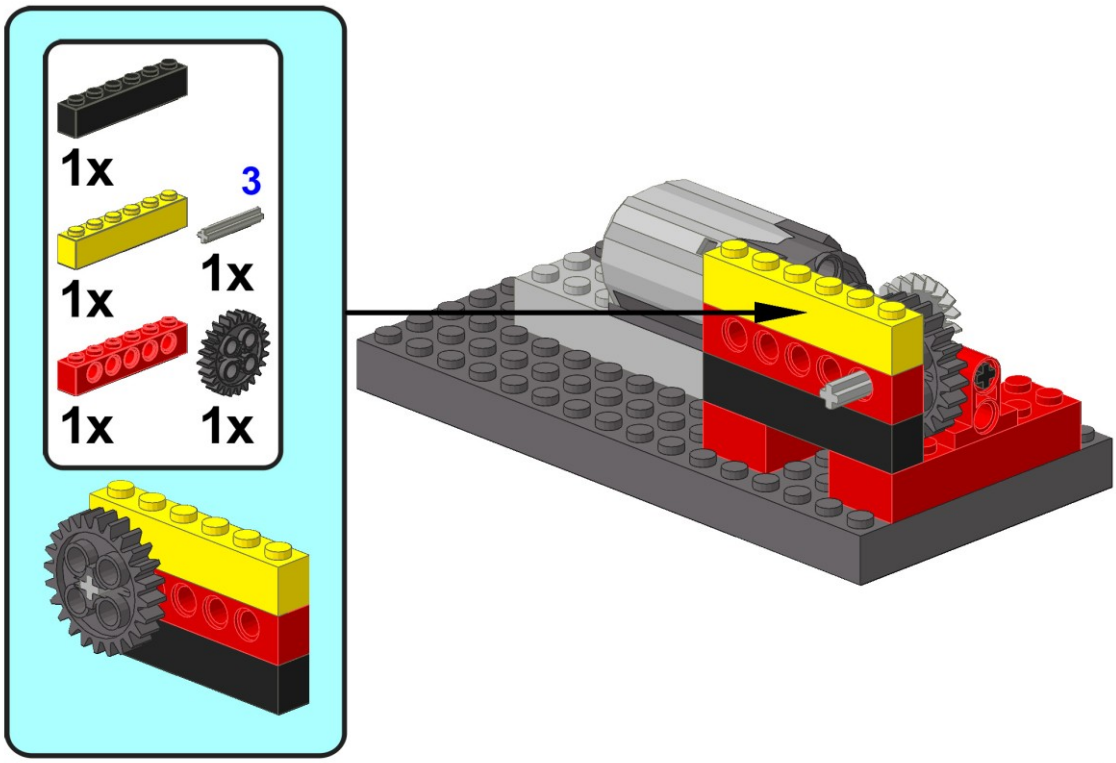

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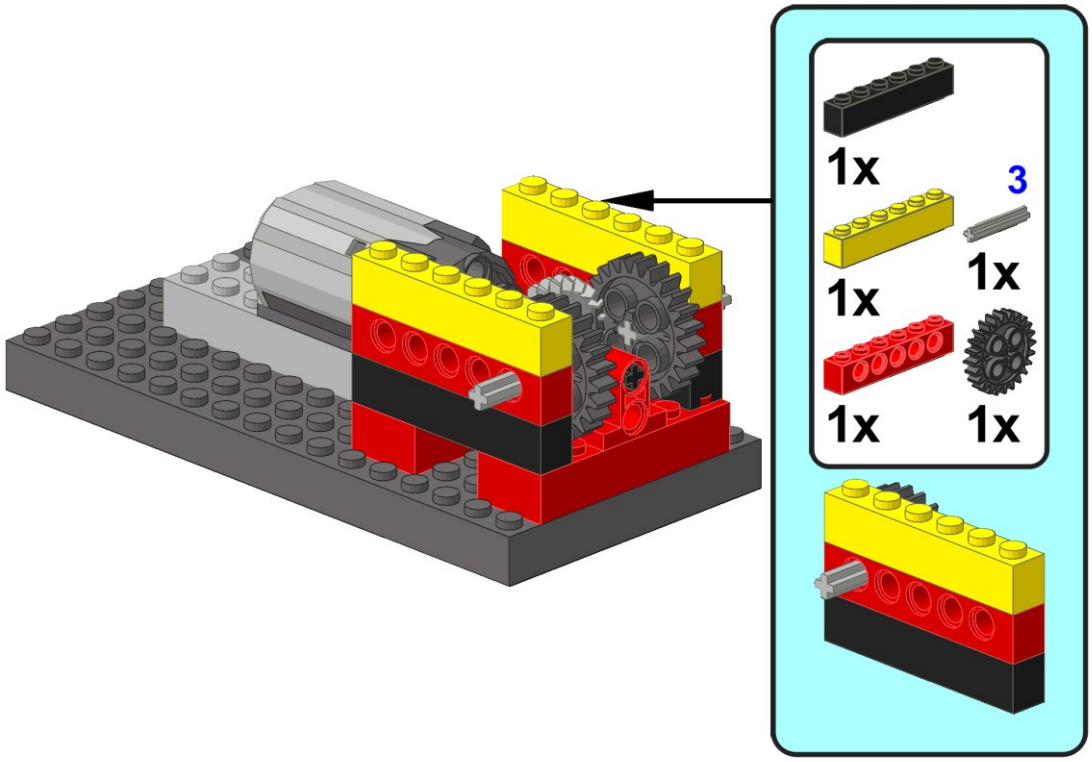

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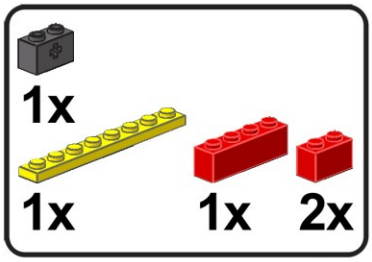

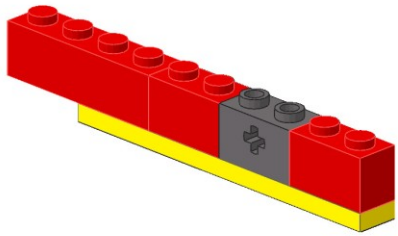

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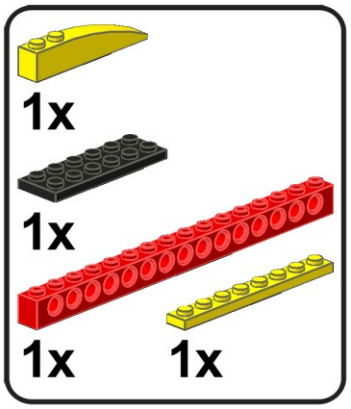

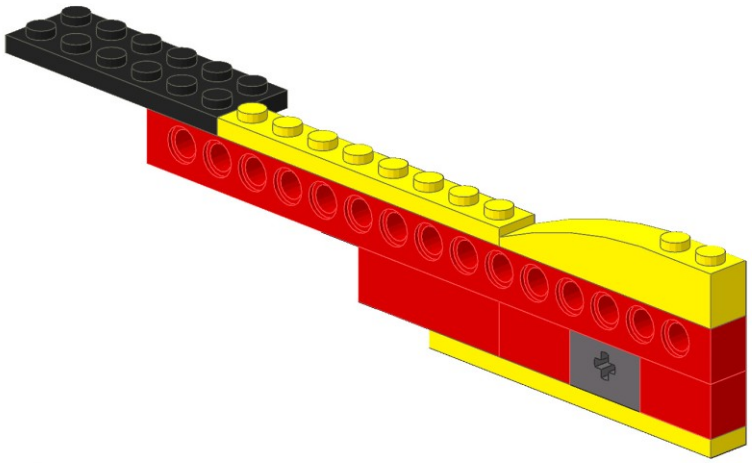

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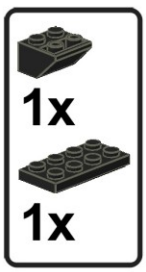

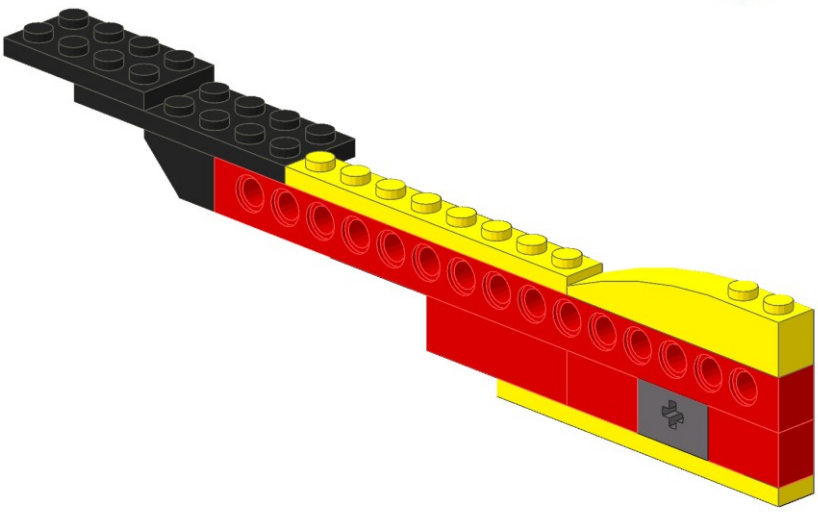

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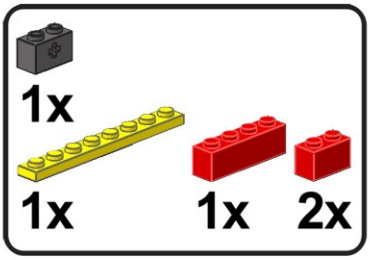

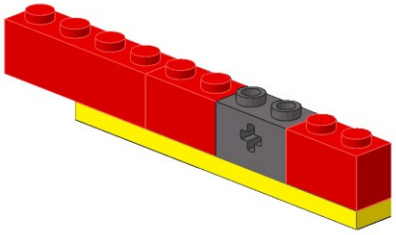

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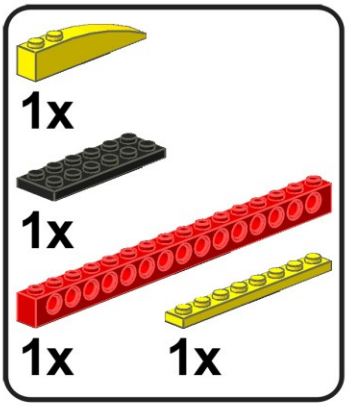

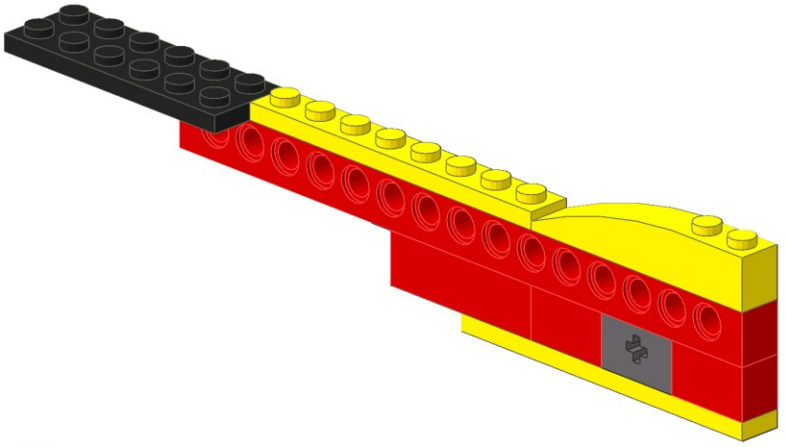

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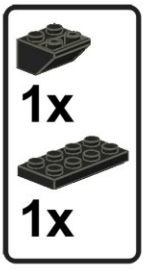

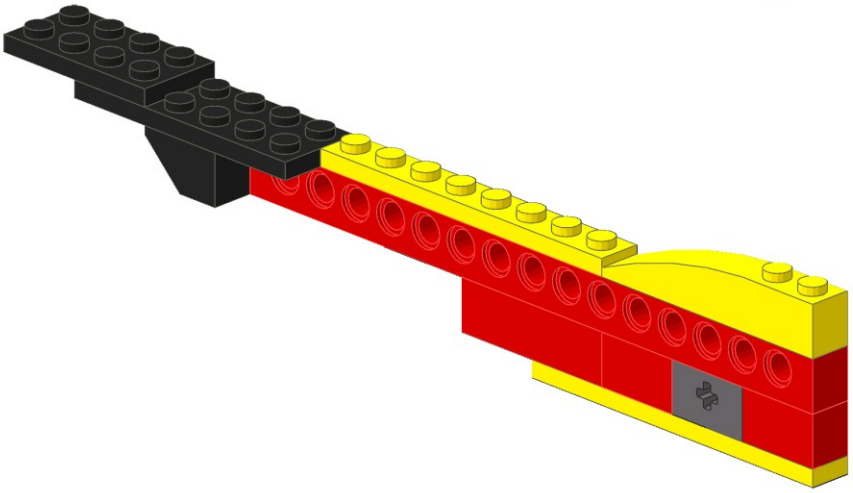

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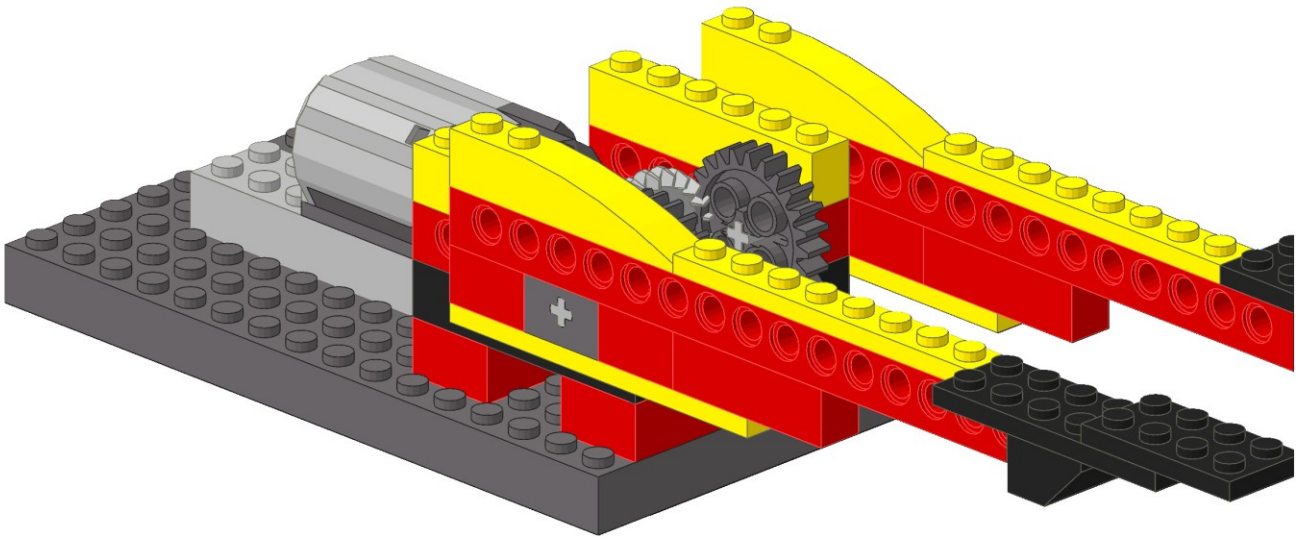

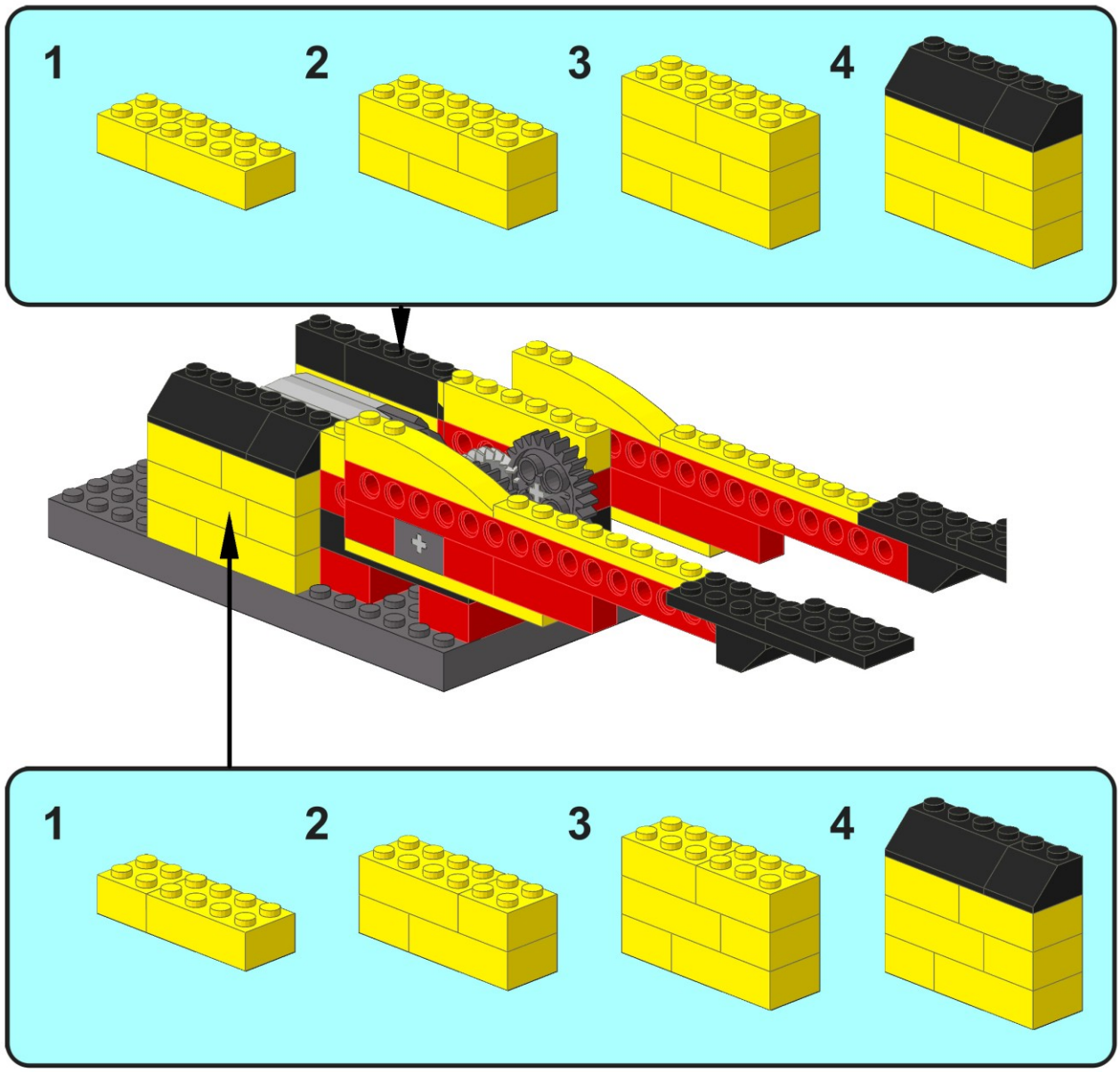
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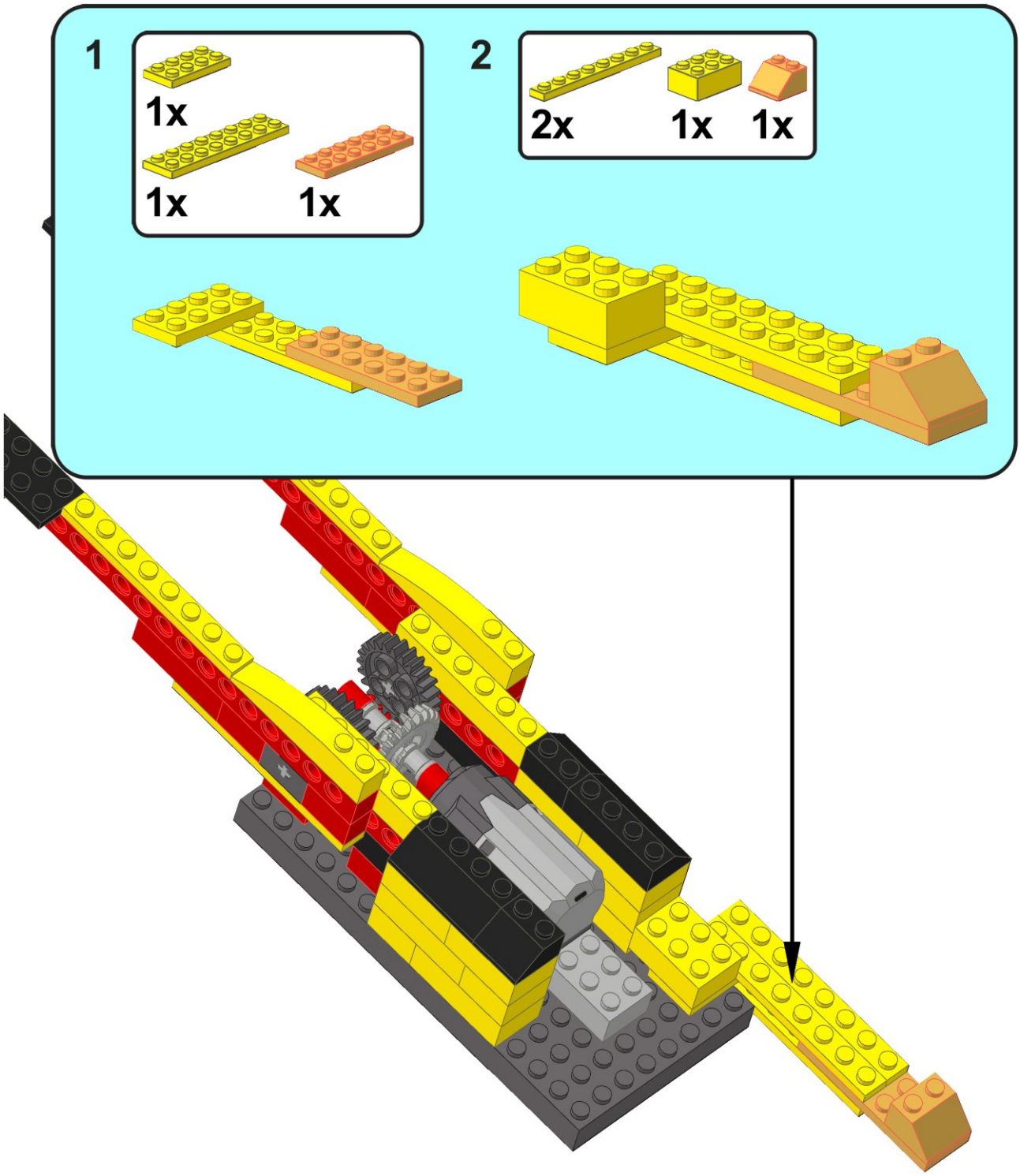
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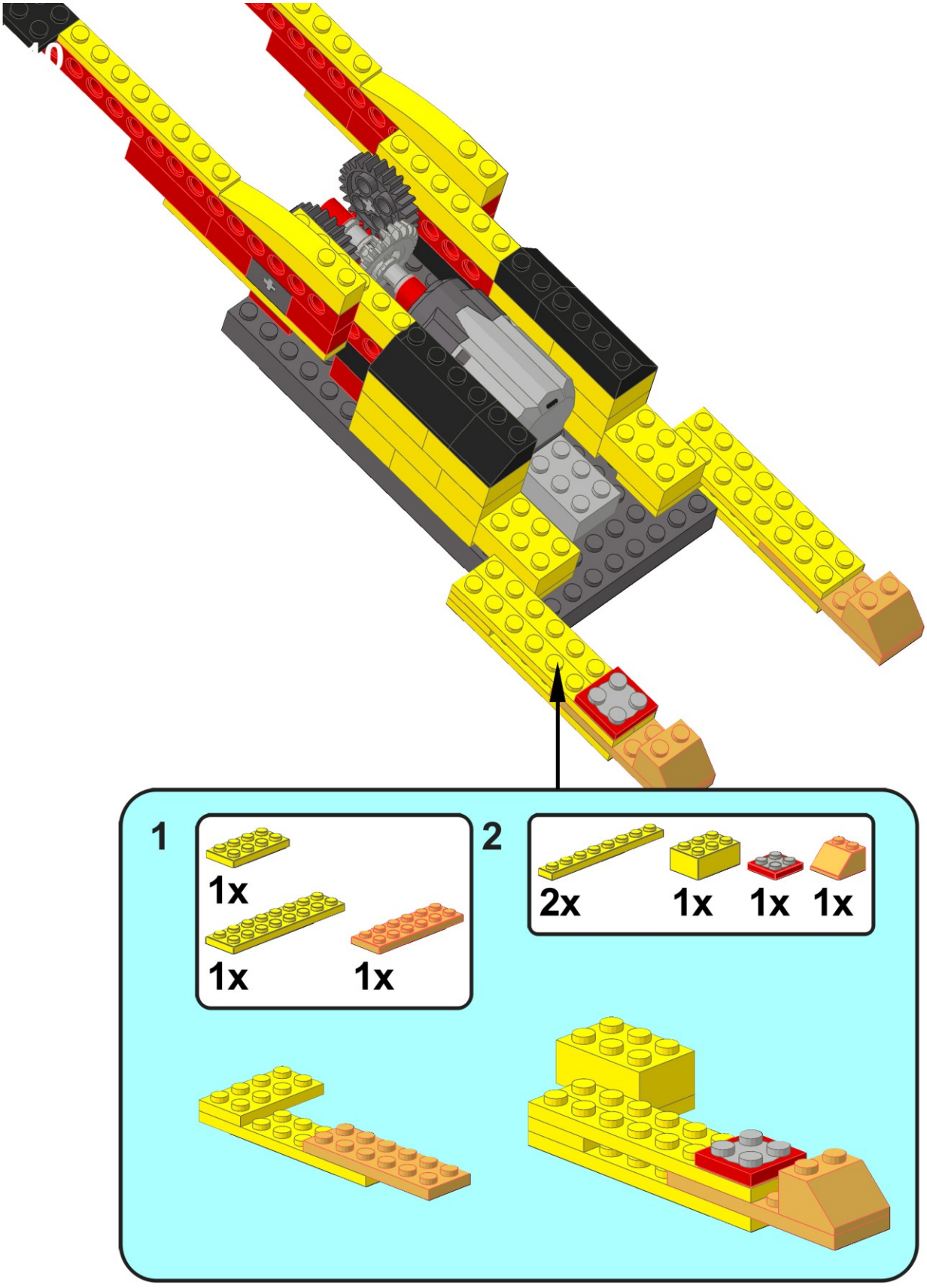
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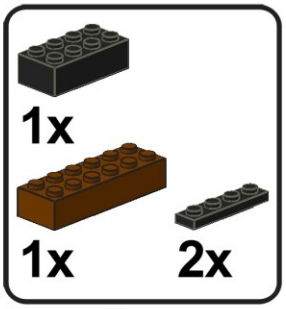

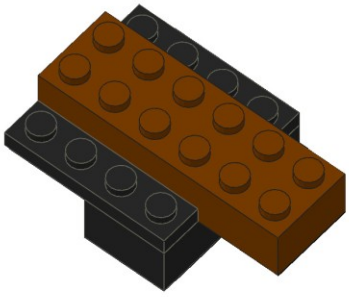

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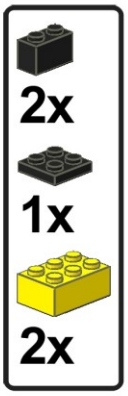

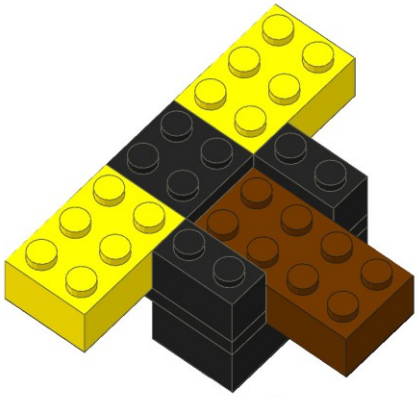

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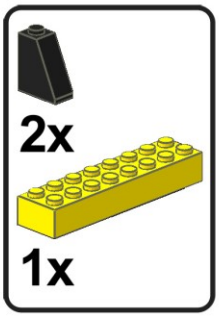

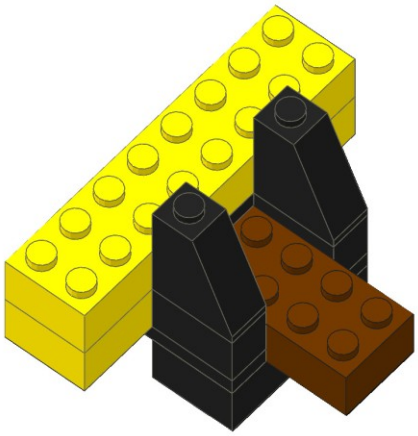

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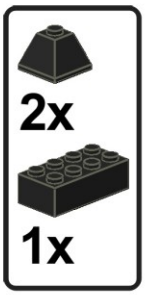

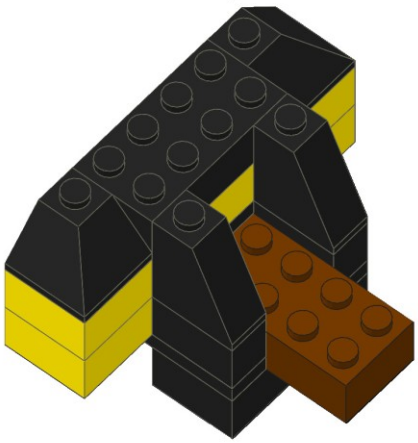

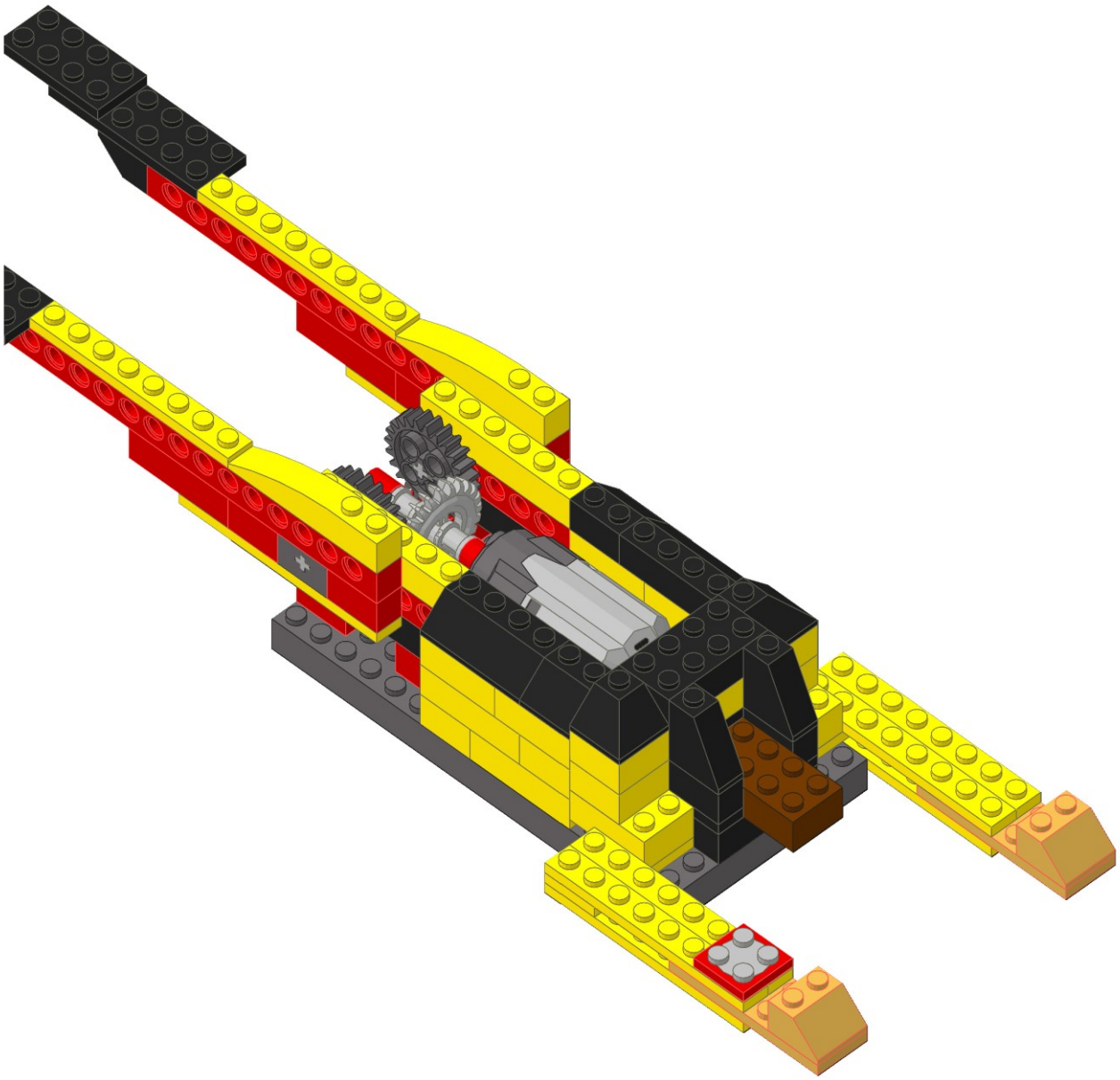

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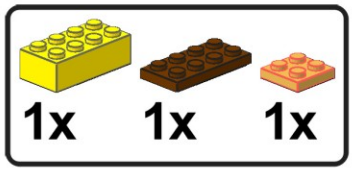

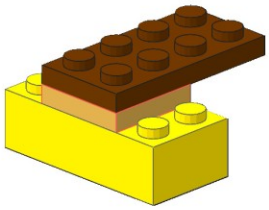

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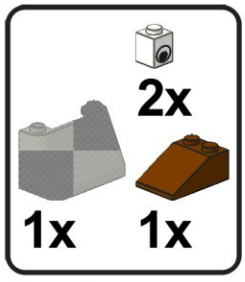

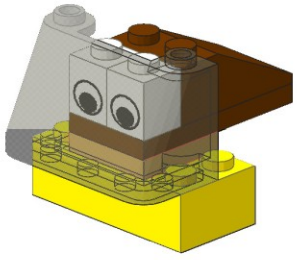

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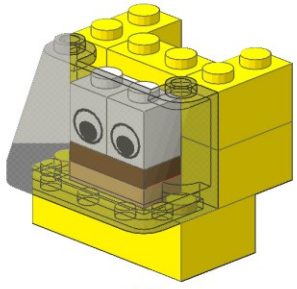

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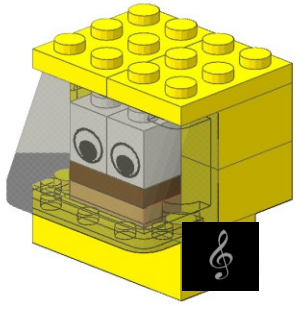

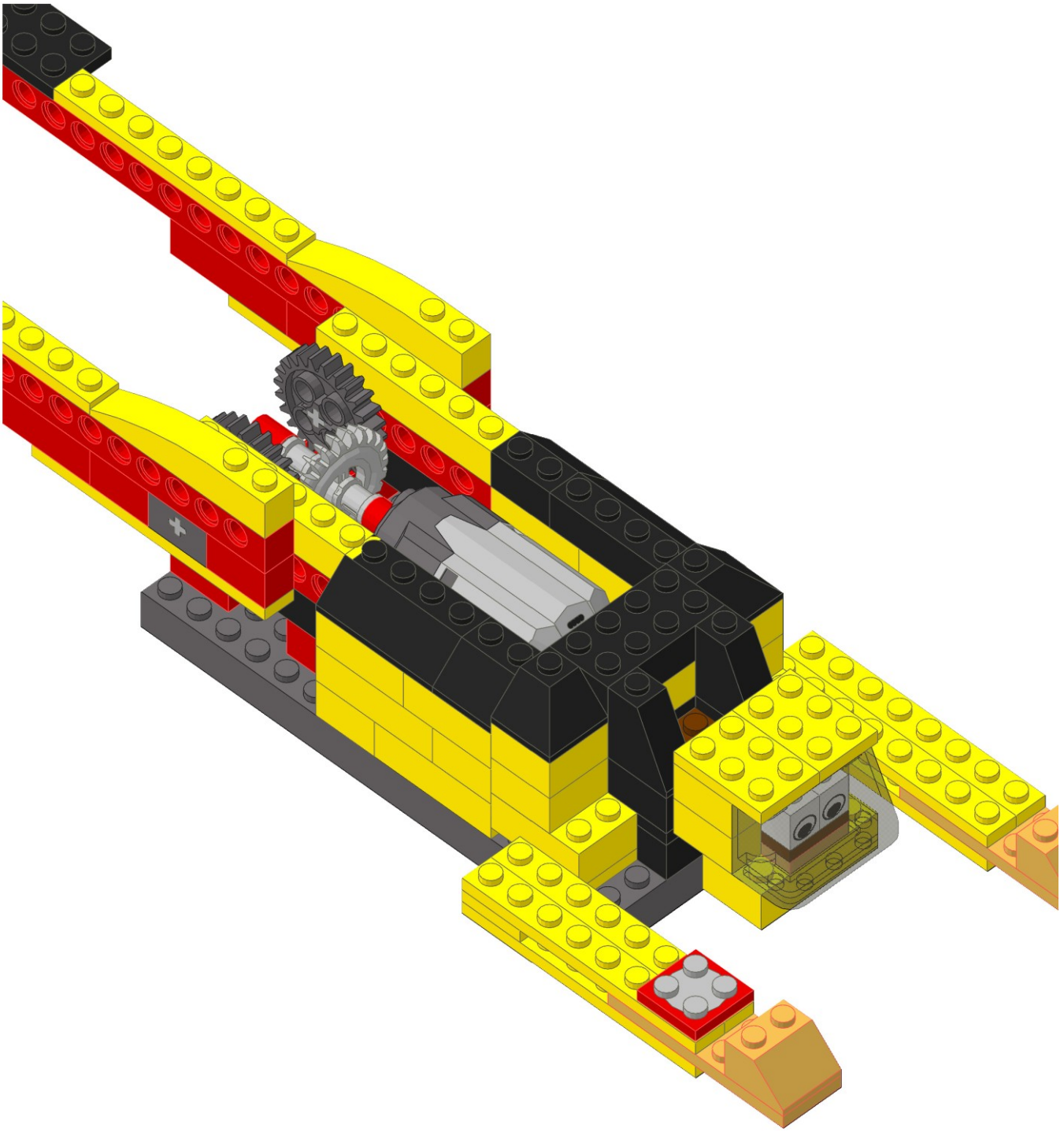

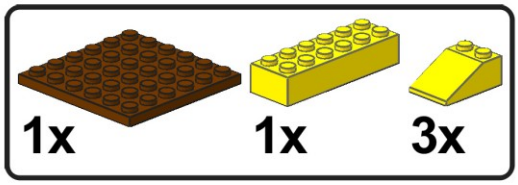
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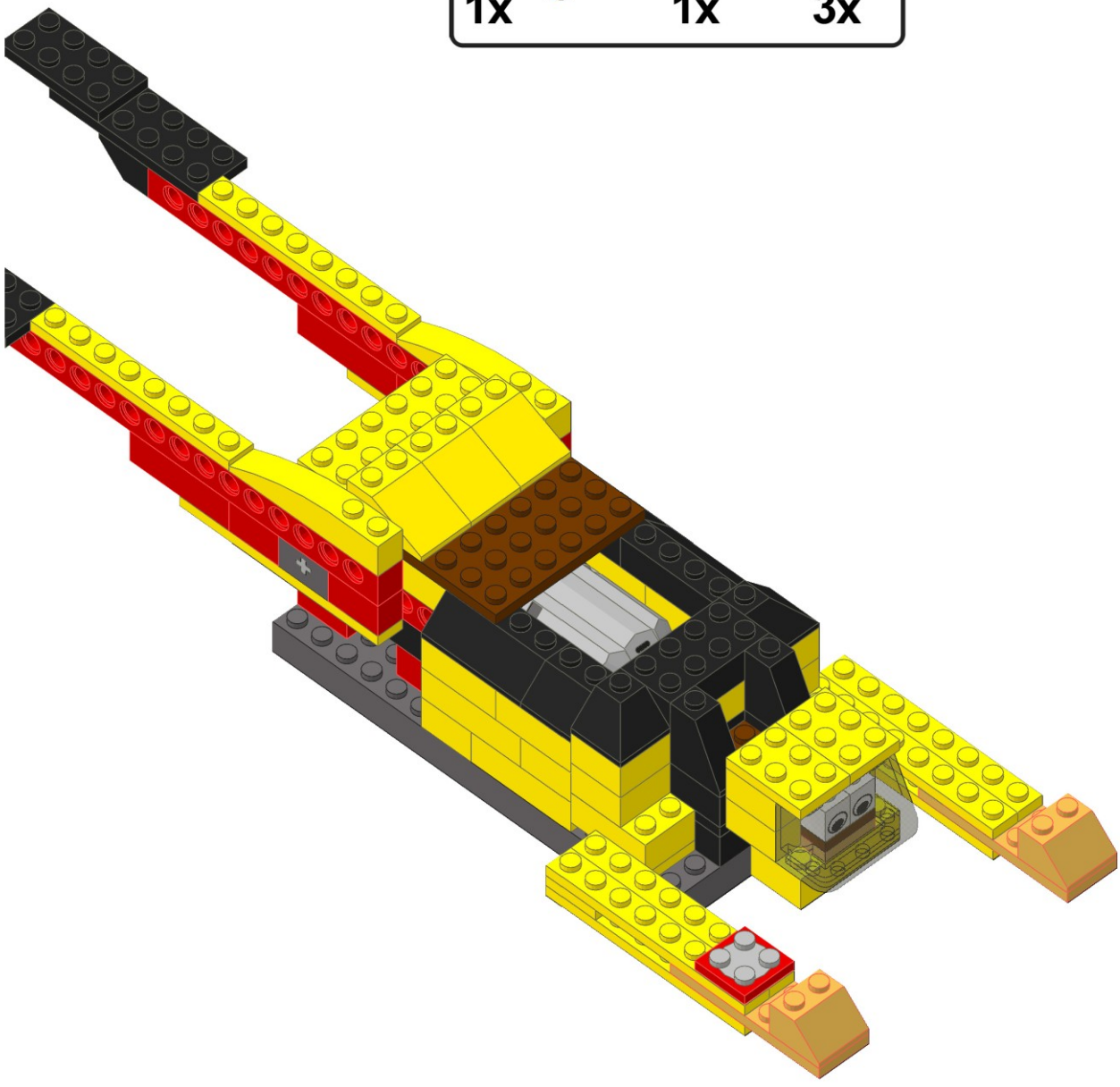


How to program the Scuba Diver

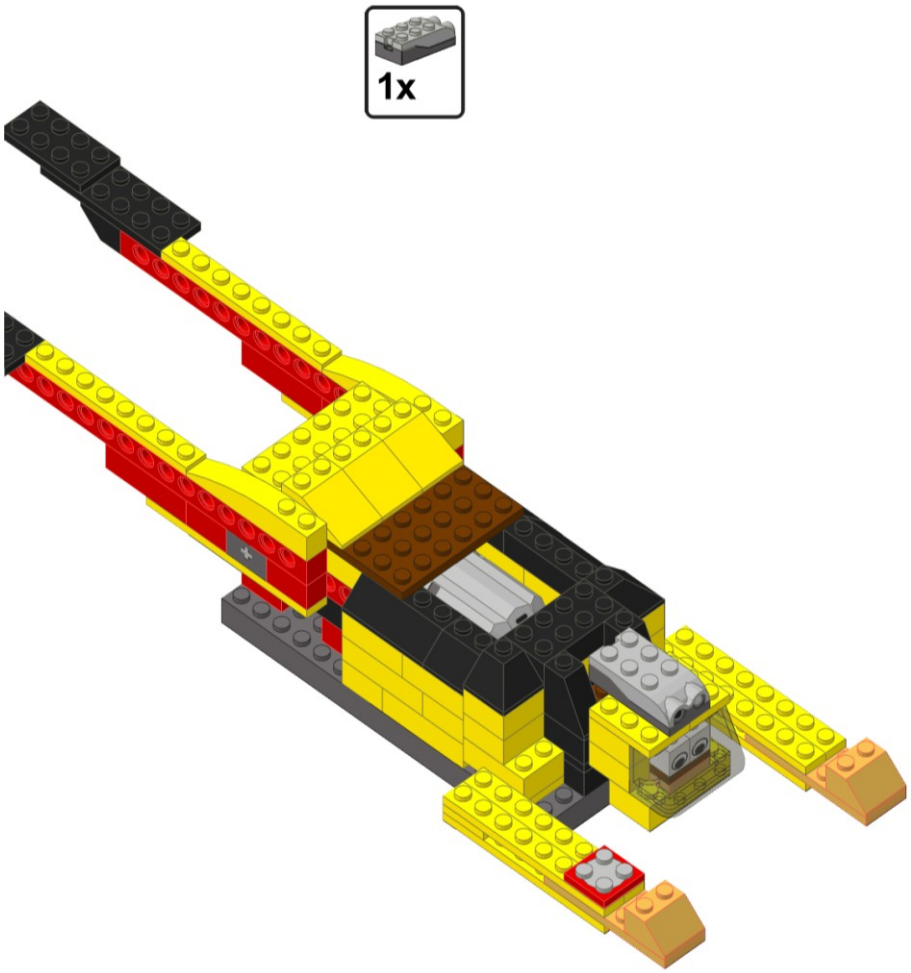
Here is an example WeDo program that will cause the diver's legs to kick.

Can you modify the program so that the diver has quick and slow kicks? What about small and large kicks?

Be careful that you do not make the kicks too big as you might break your model!

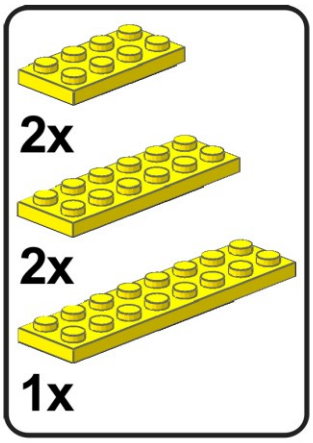
- Set the power level to 1
- Spin the motor 'this way'
- Wait for 3/10th of a second
- Spin the motor 'that way'
- Wait for 3/10th of a second
- Repeat

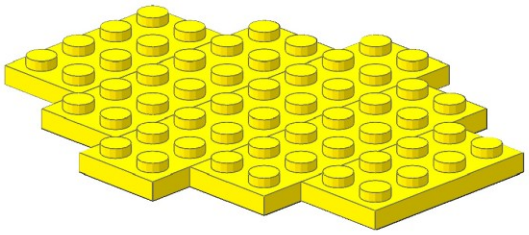
Lets now make it interactive!
Add the 'motion' sensor to the diver's body. This next program will show you how to make your diver paddle along at a leisurely pace until something moves nearby (a shark perhaps?!?). This program paddles until the motion sensor is triggered. The diver then waits 3 seconds (30 / 10th of a second) and then continues swimming.



Building Instructions Tropical Fish

1





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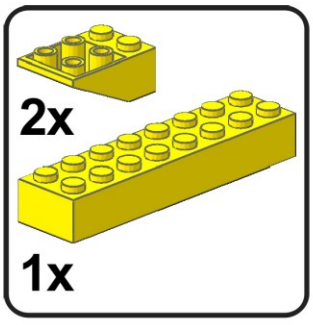

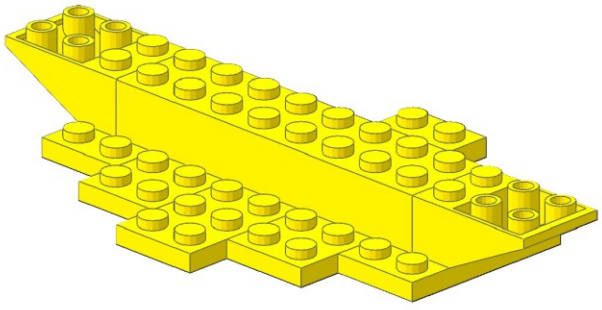

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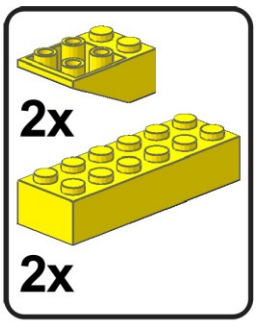

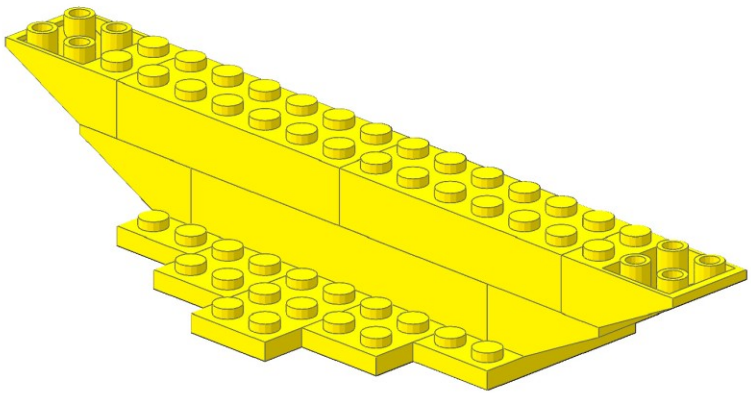

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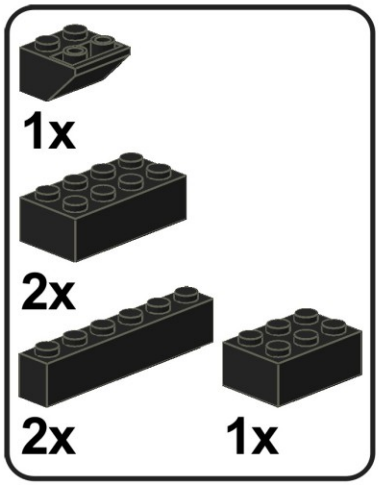

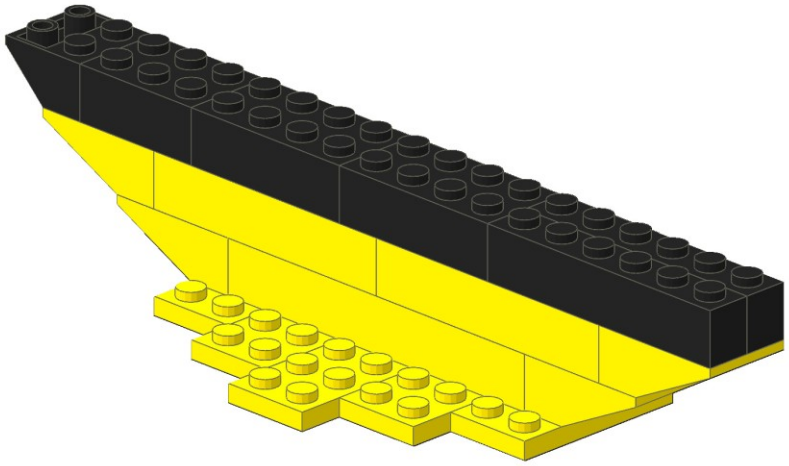

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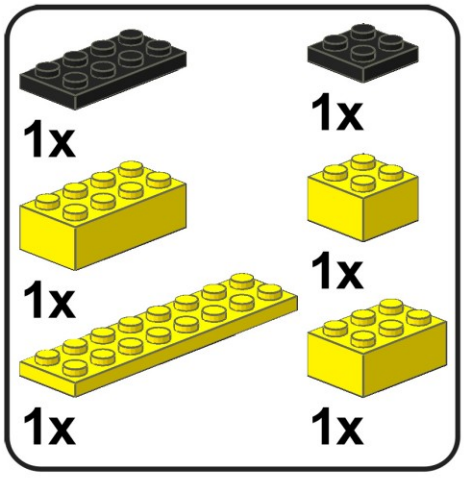

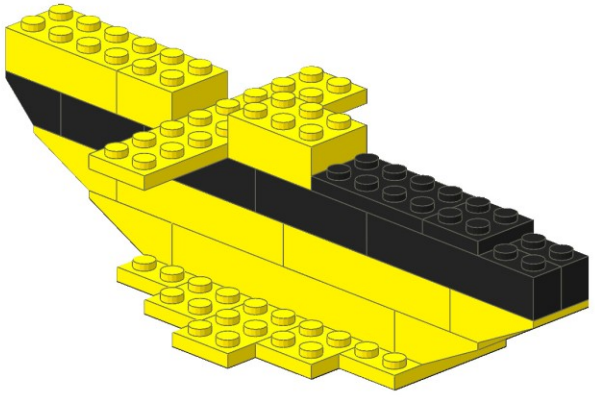

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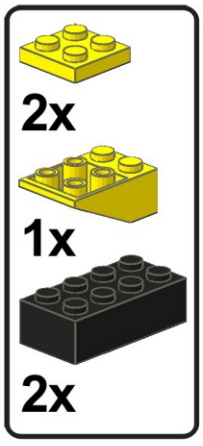

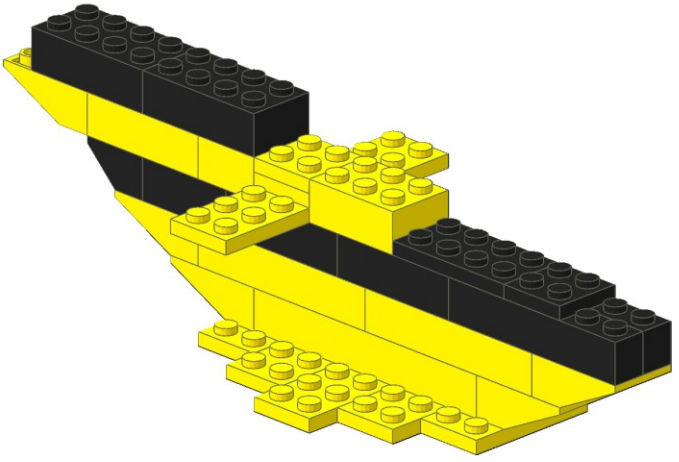

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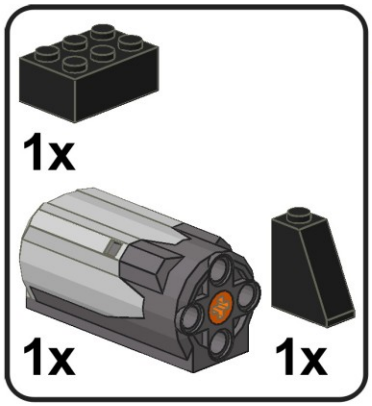

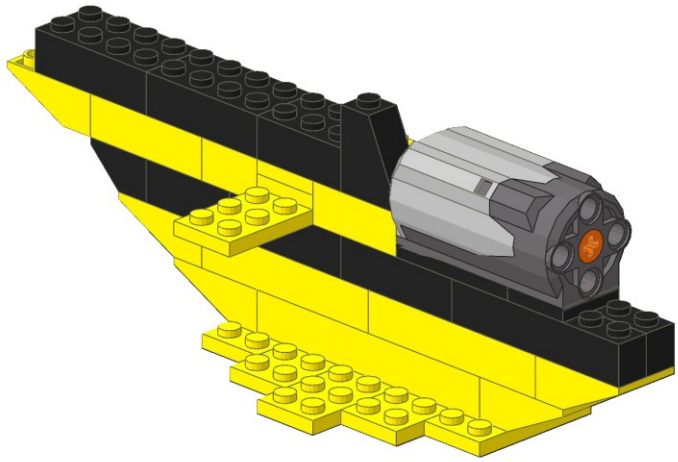

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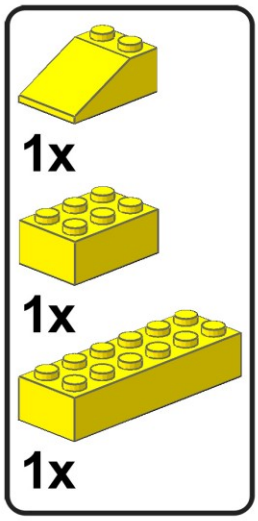

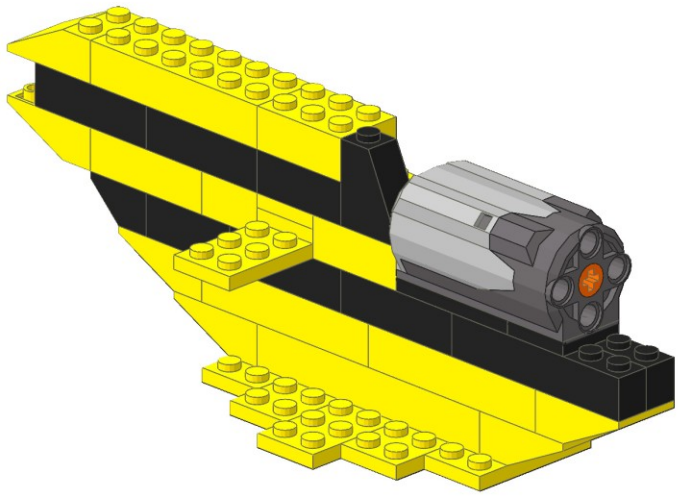

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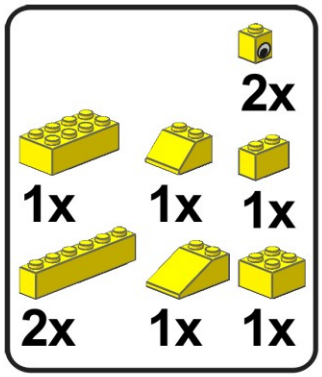

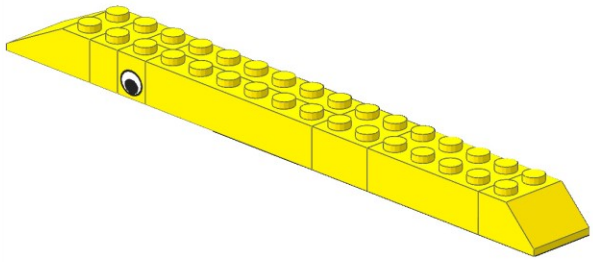

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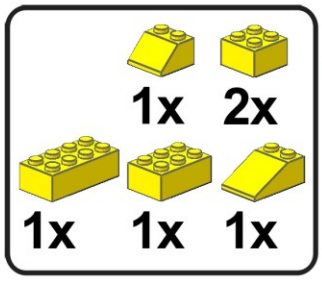

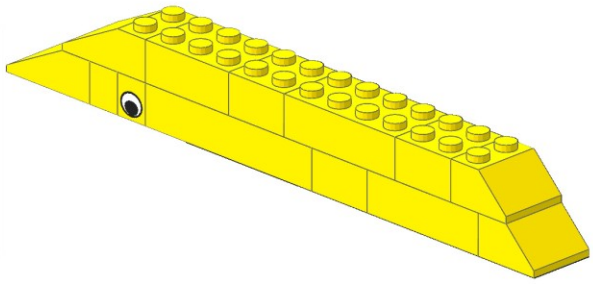

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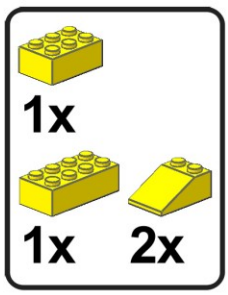

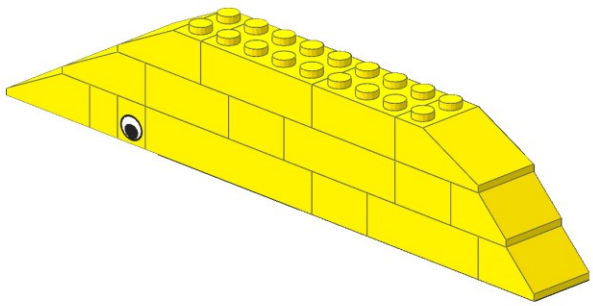

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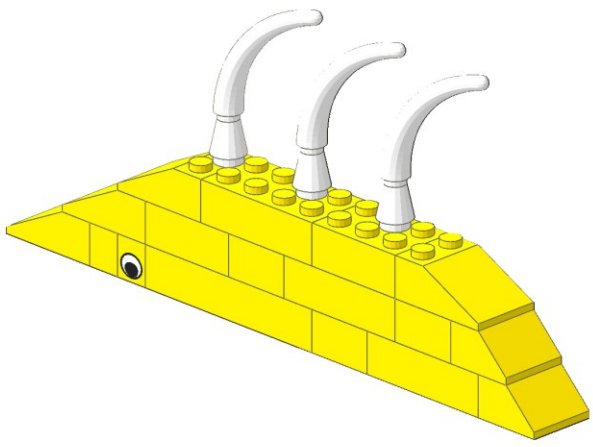

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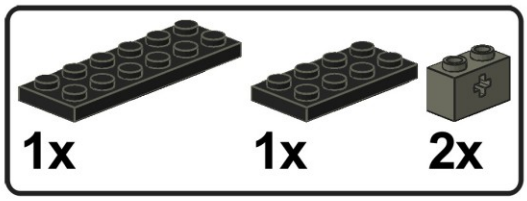

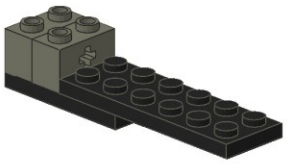

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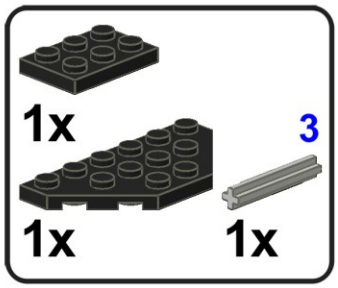

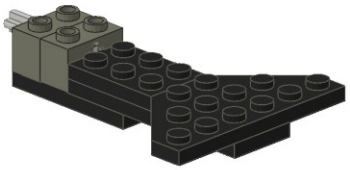

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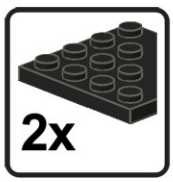

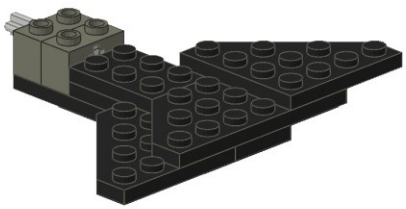

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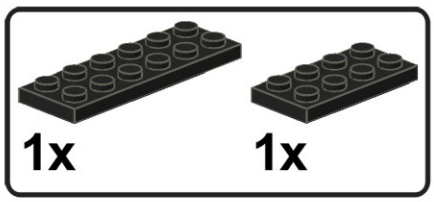
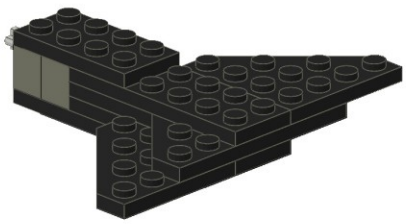
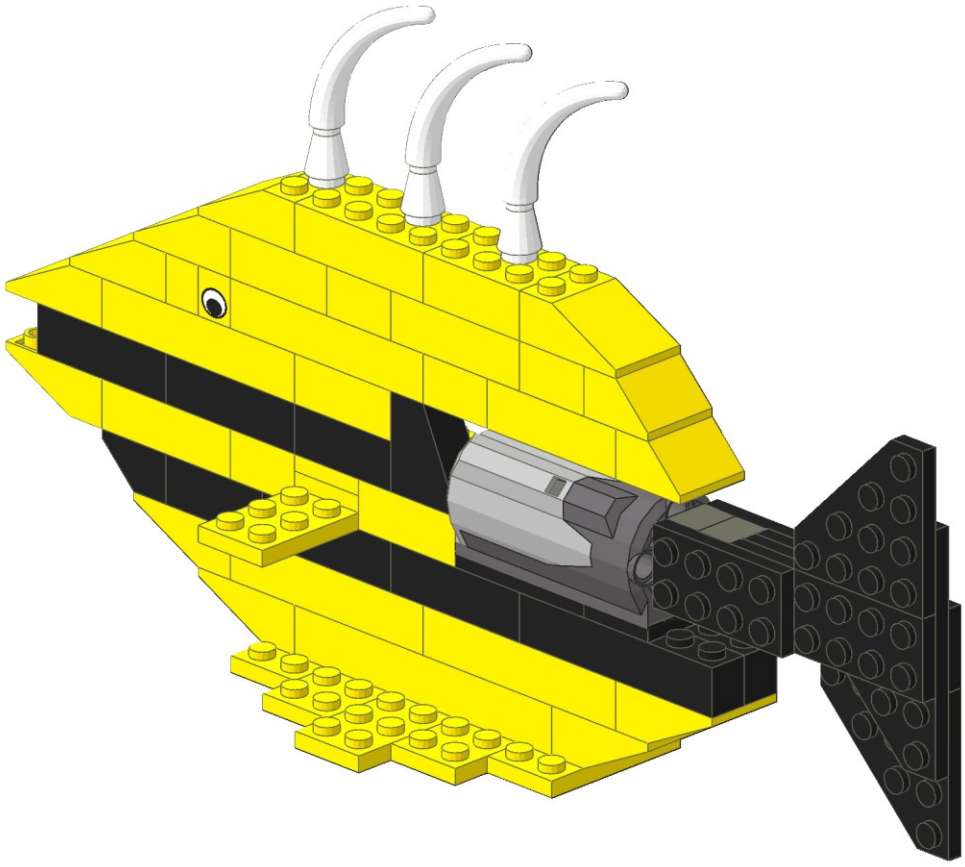






How to program the Fish

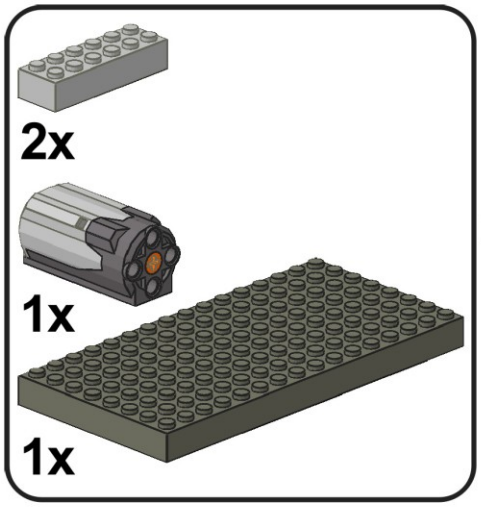
Here is an example WeDo program that will cause the fish's tail to spin at different power levels (speeds)

Can you come up with your own patter of fast and slow swimming?

Can you change your fish to look like another species?

Building Instructions Manta Ray

1



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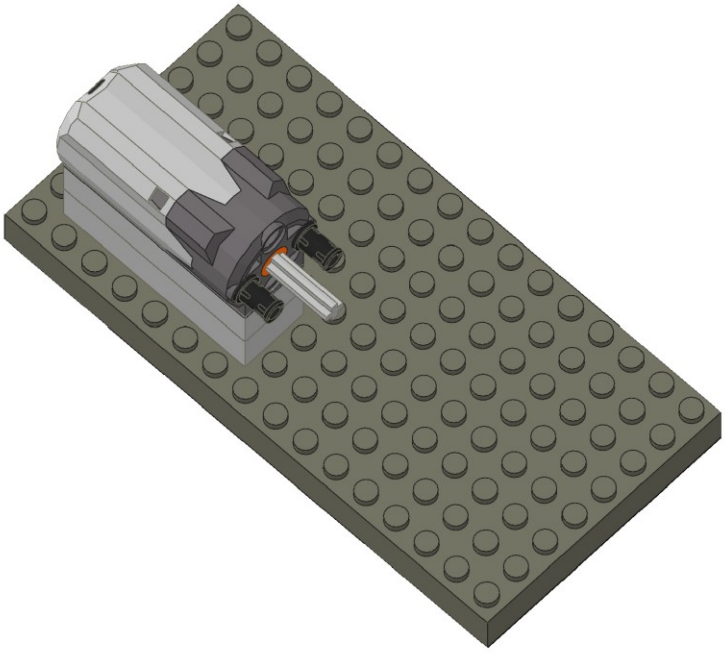

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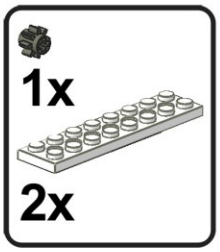

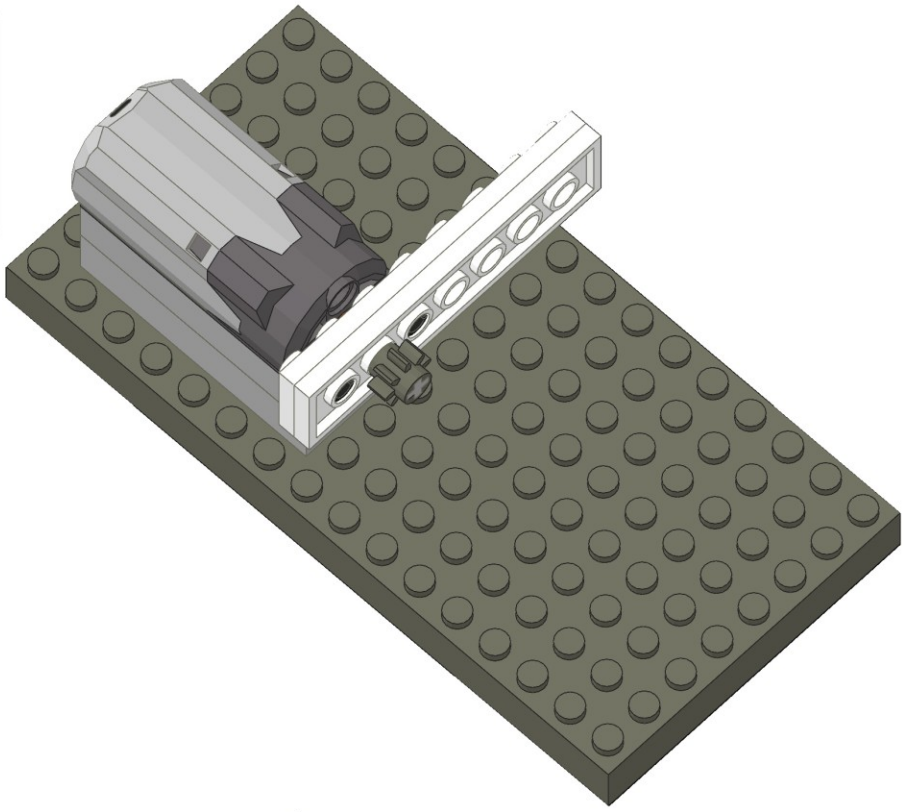

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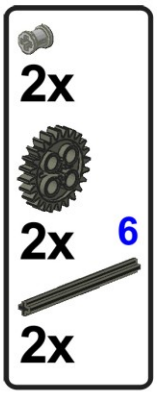

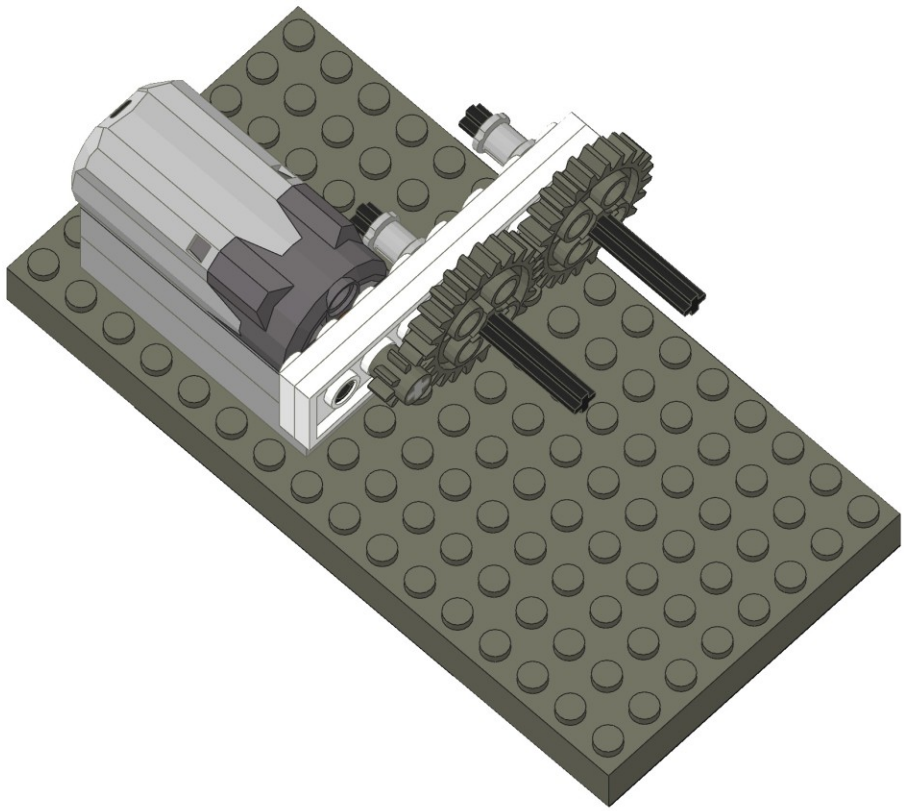

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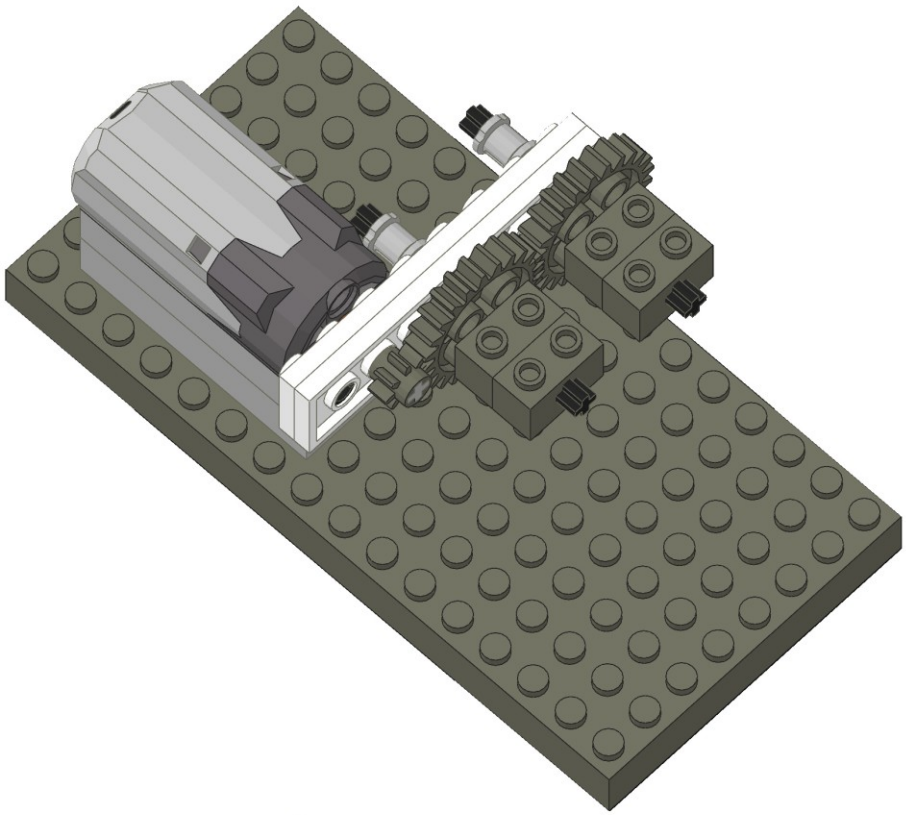

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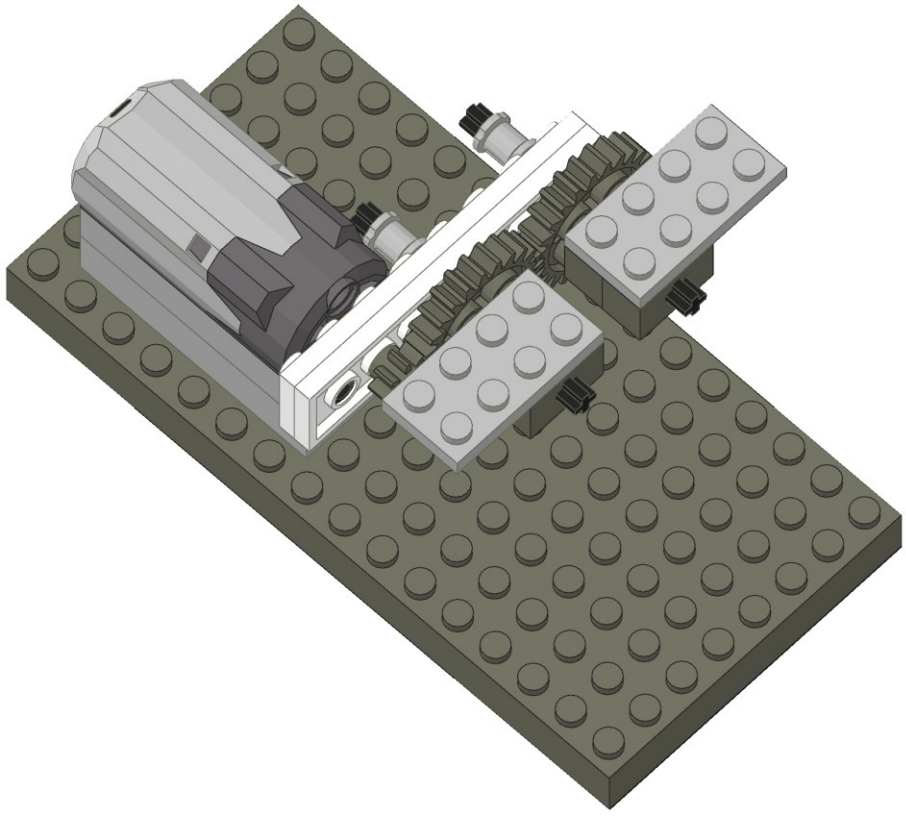

Left Wing

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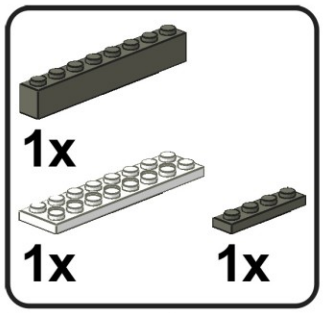

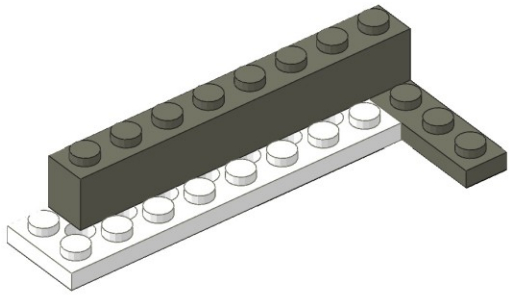

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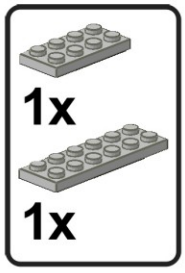

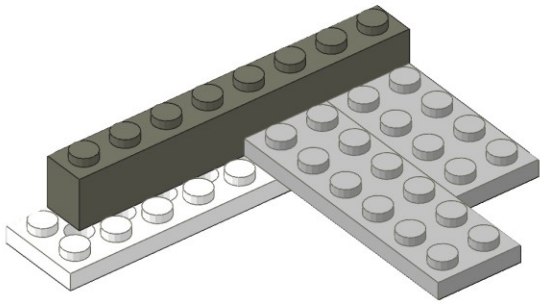

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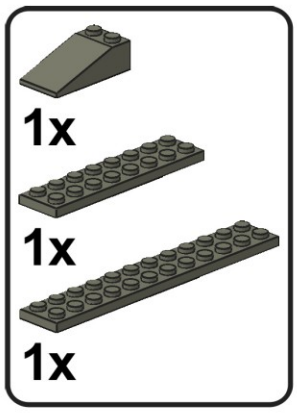

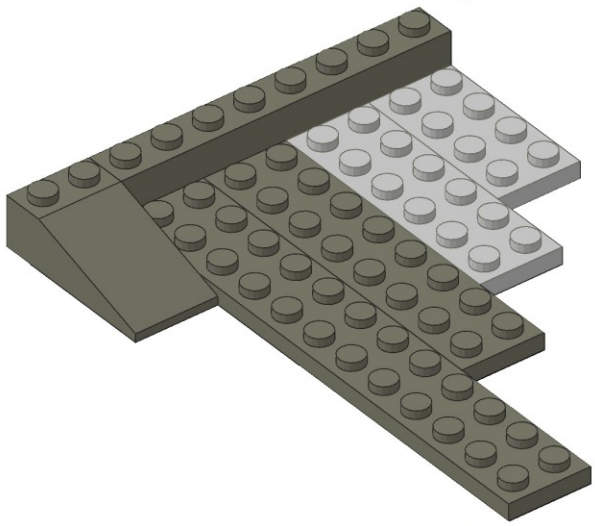

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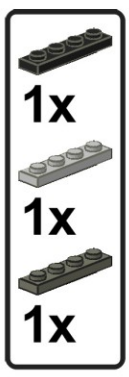

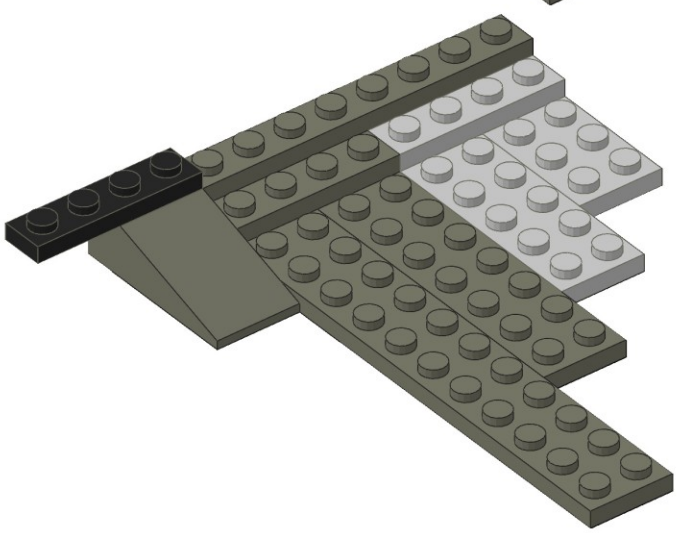

Right Wing

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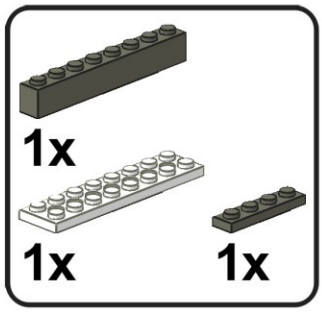

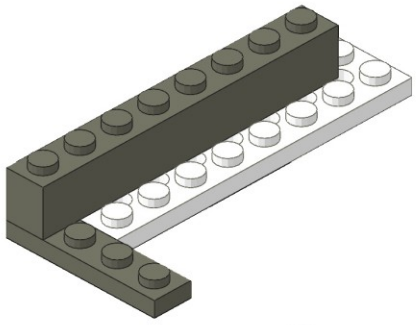

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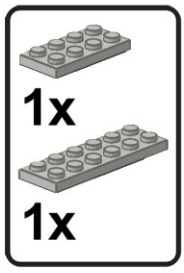

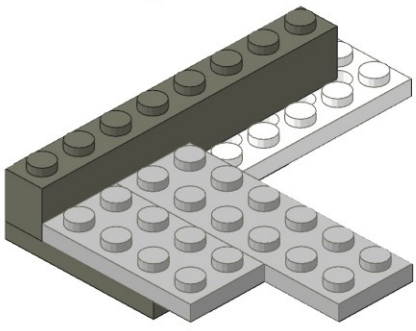

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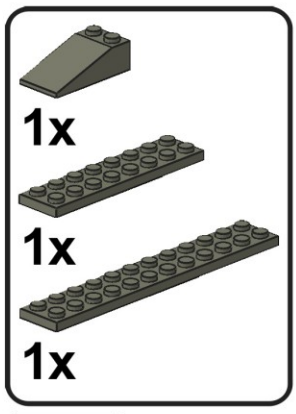

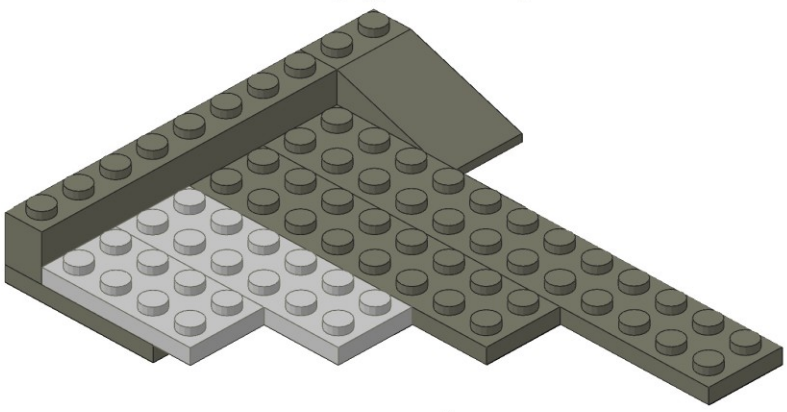

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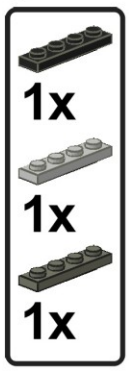
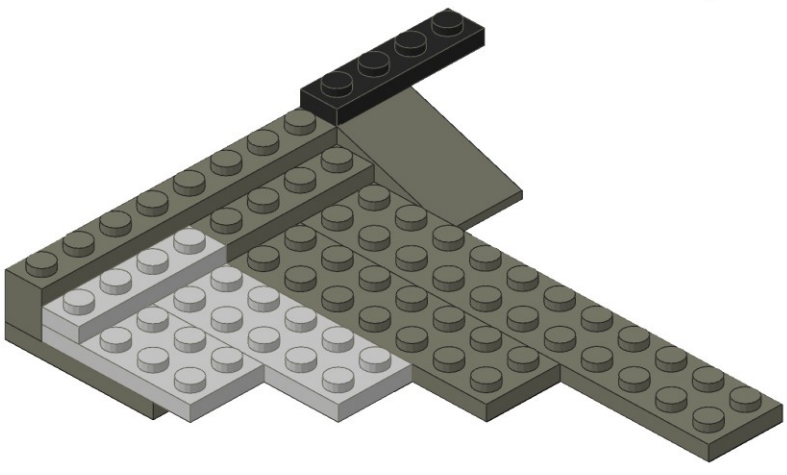
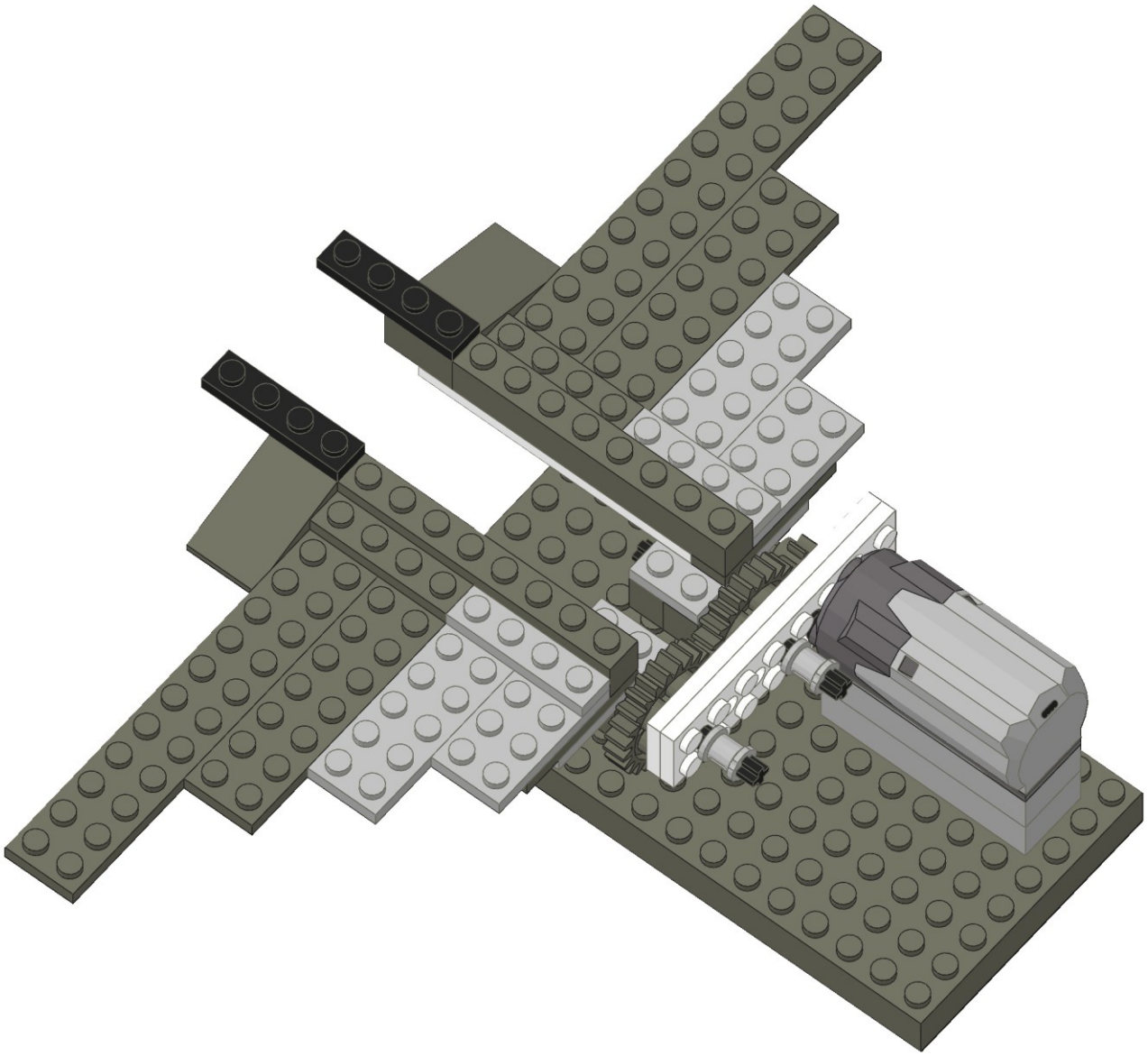
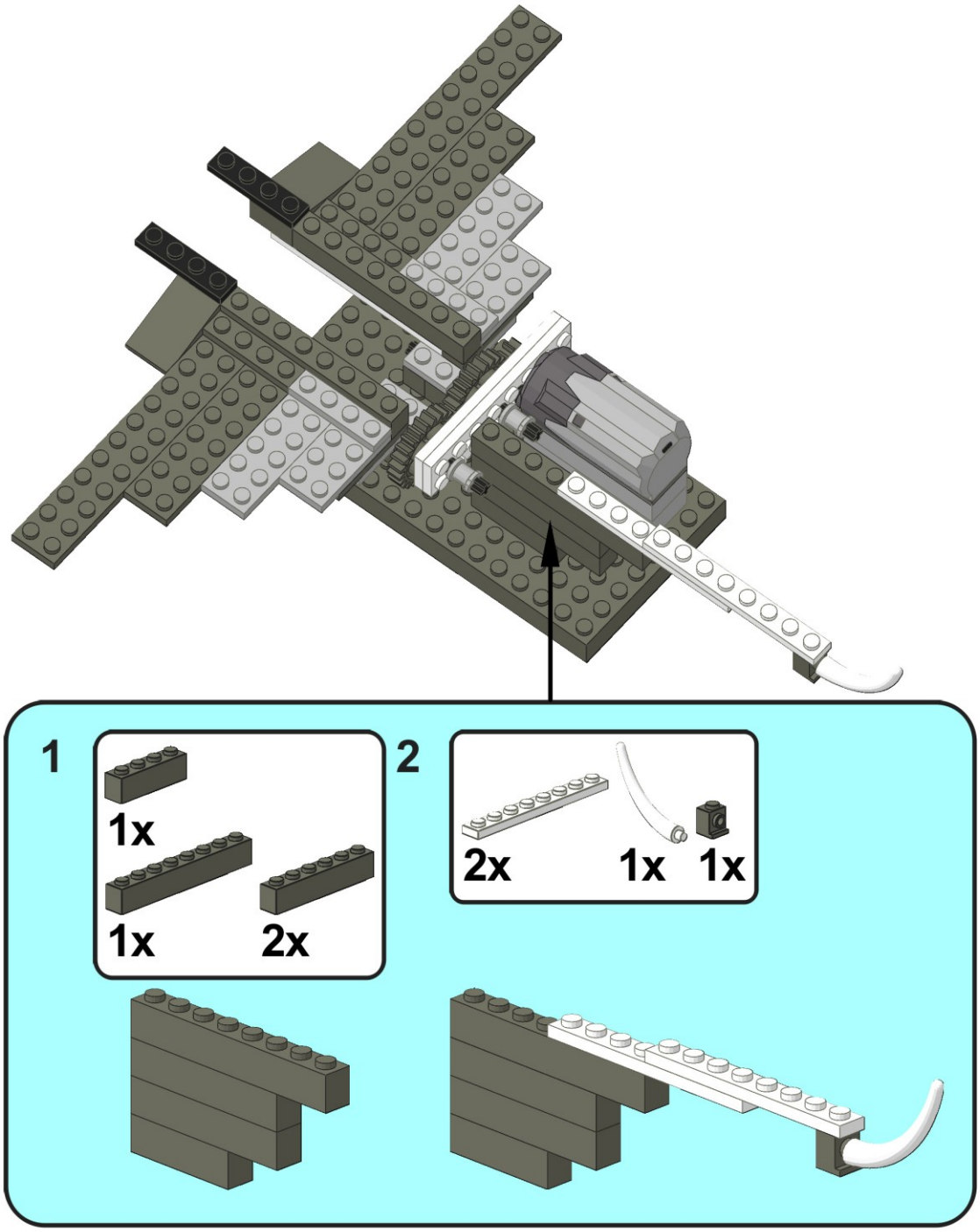




Attach the left and right wings.
Make sure you keep the space in between them



Tail

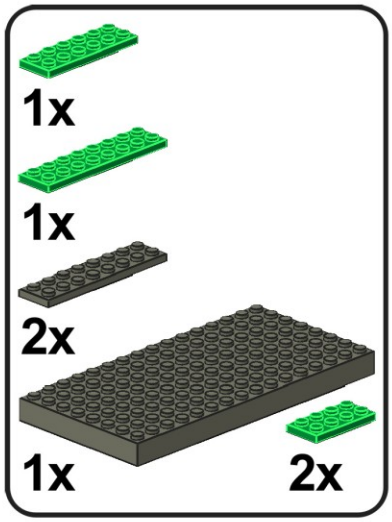


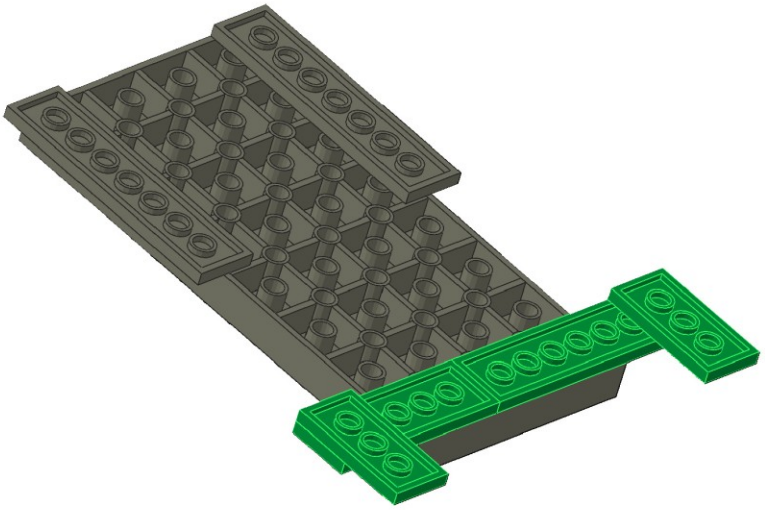
Programming the Manta Ray

The Manta Ray can be programmed the same as the Scuba Diver. The motor slowly turns in one direction, and then reverses direction for the same amount of time. These commands are repeated over and over again.

Building Instructions - Sea Turtle

1





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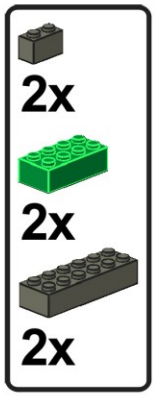

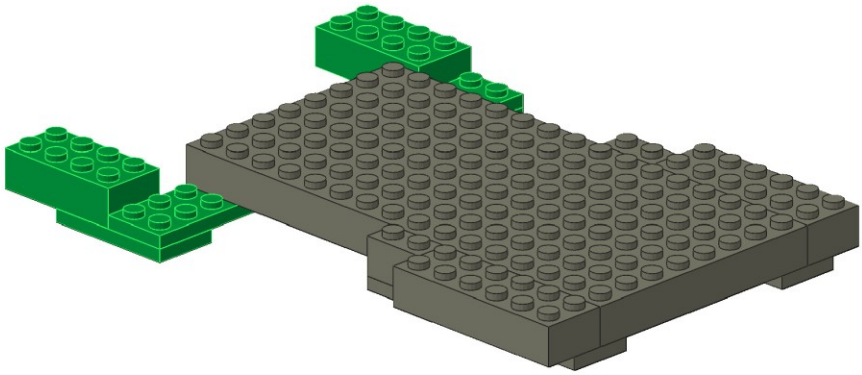

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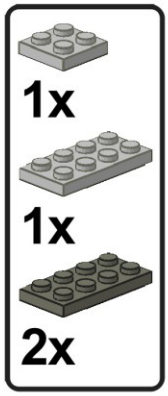

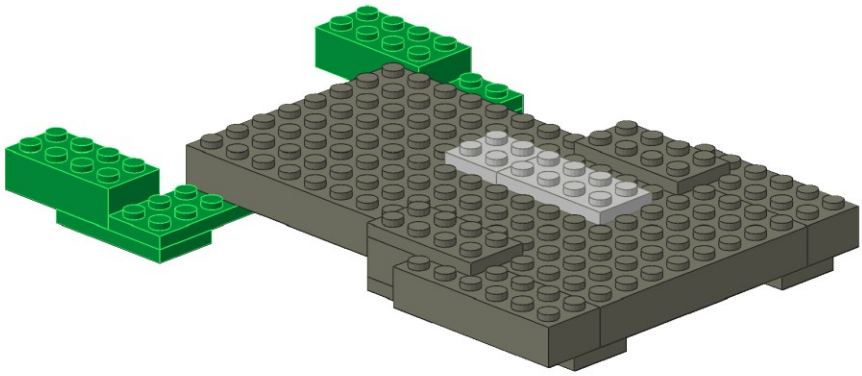

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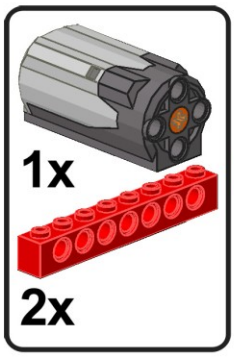

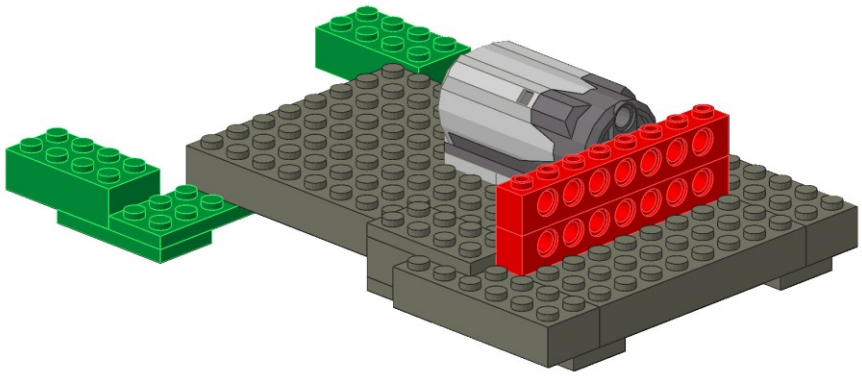

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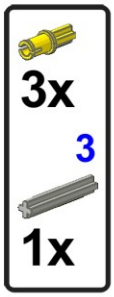

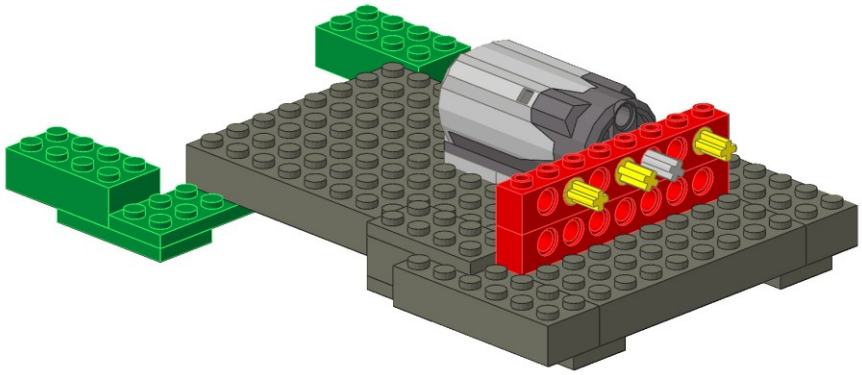

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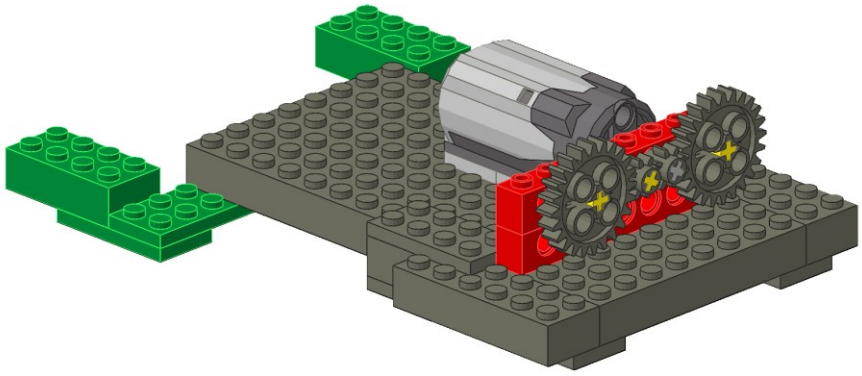

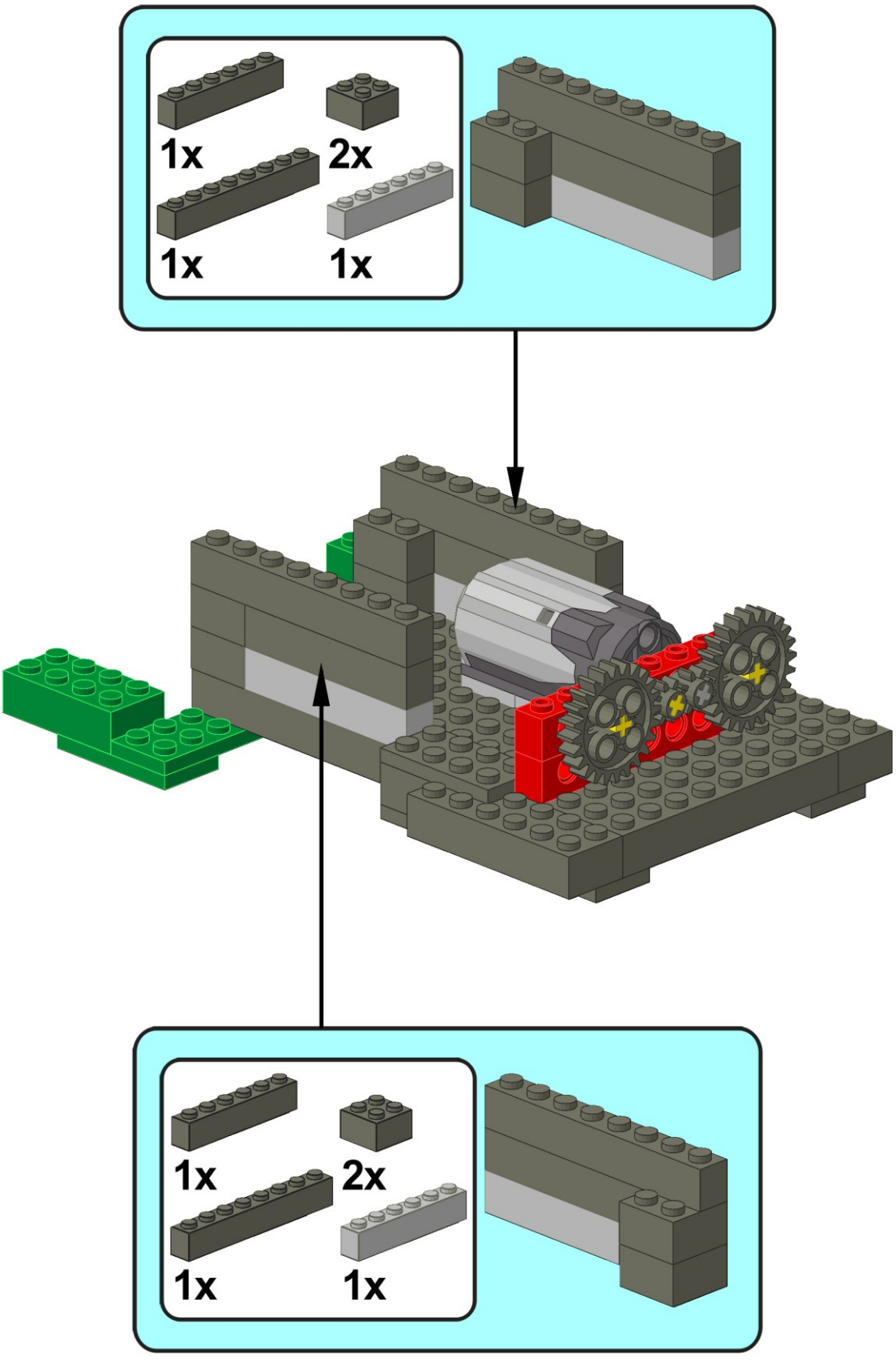
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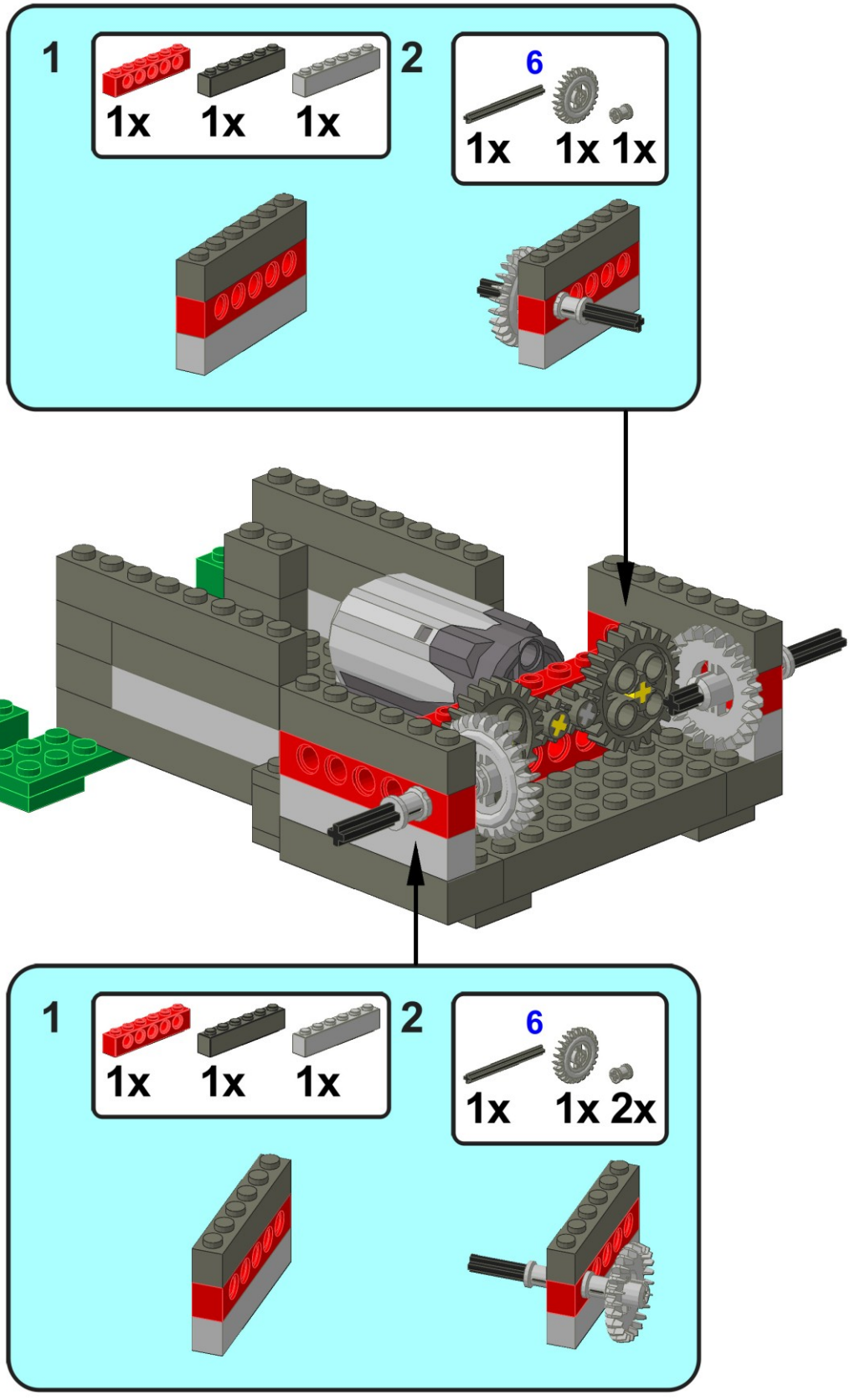
1x
1x
1x
2x
1x
1x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1x
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1x
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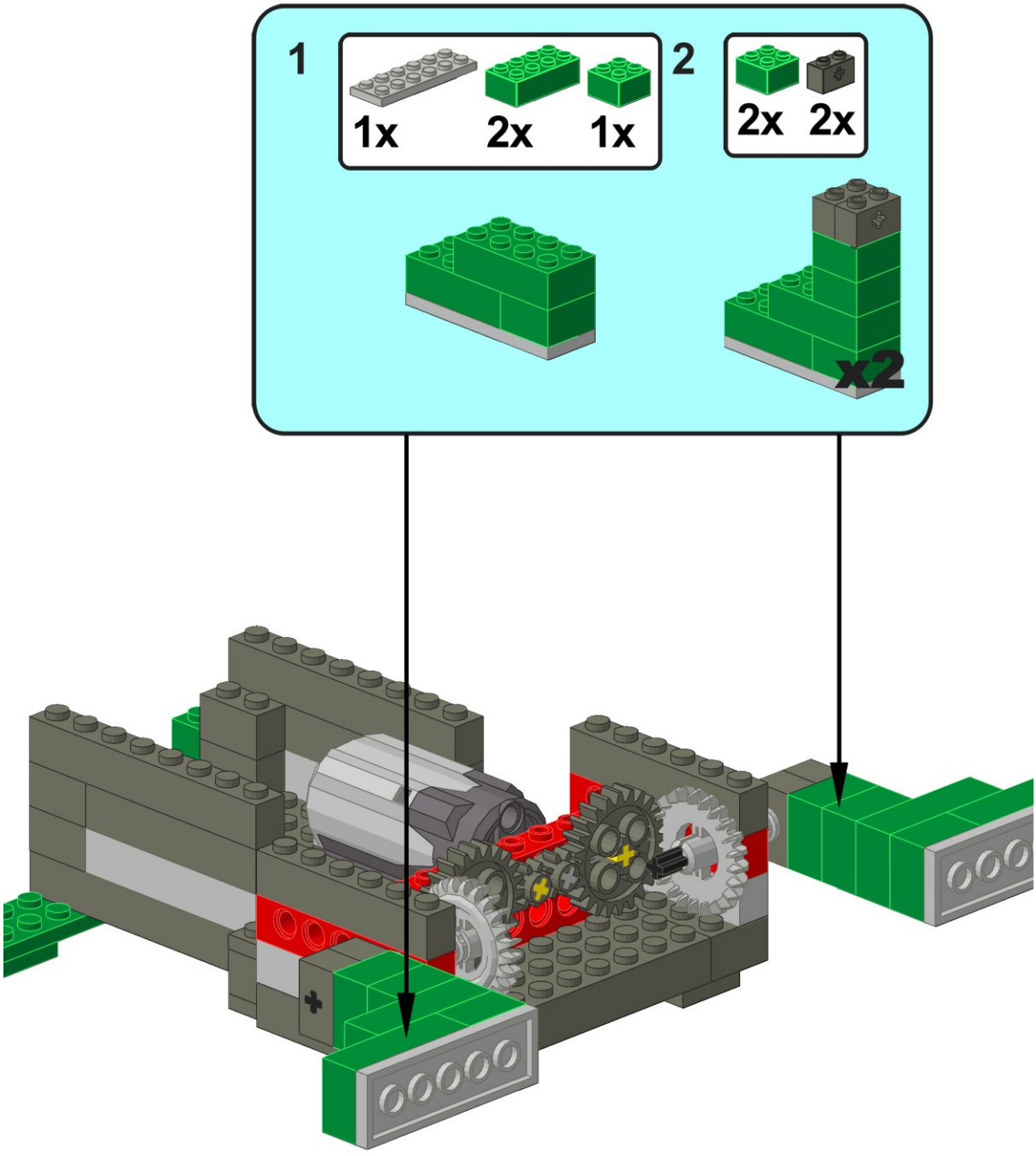
1x
2
6
1x
1x
2x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2
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2x
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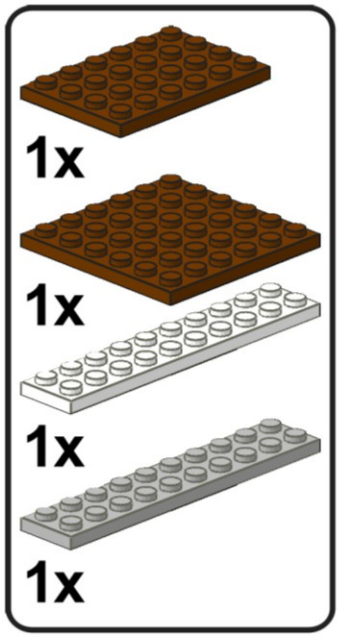
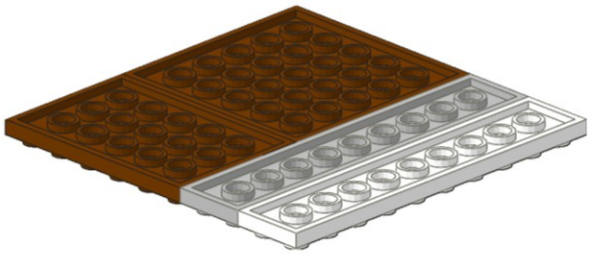
Top Shell

1





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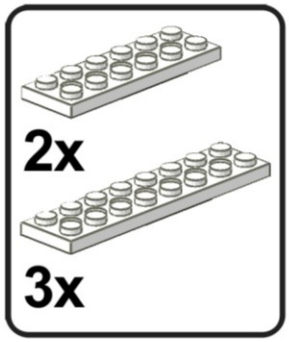

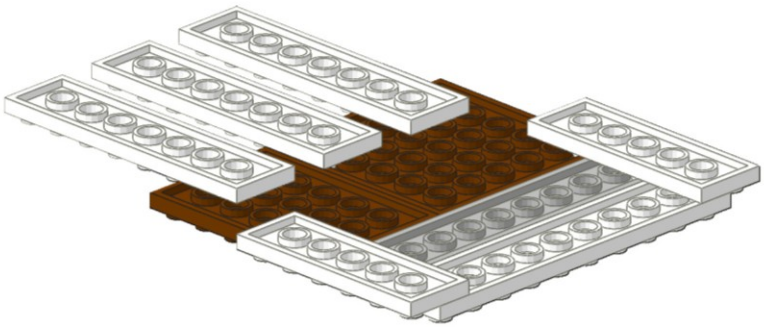

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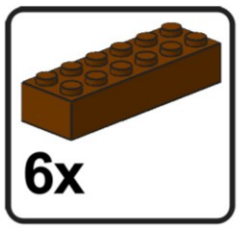

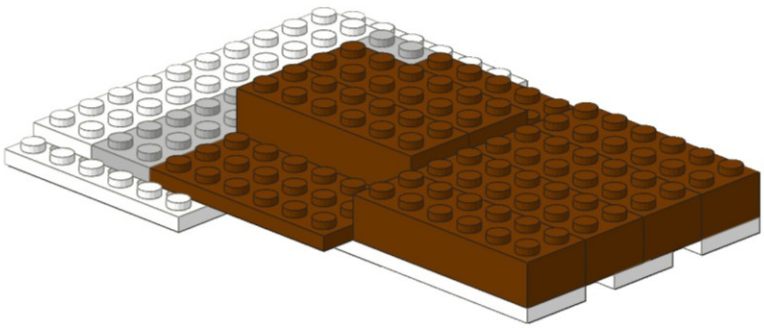

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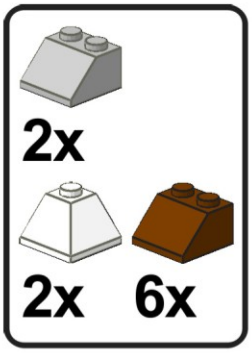

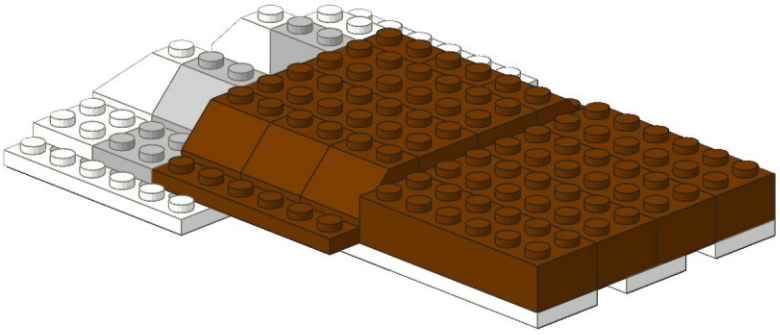

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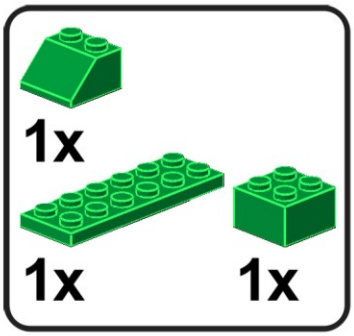

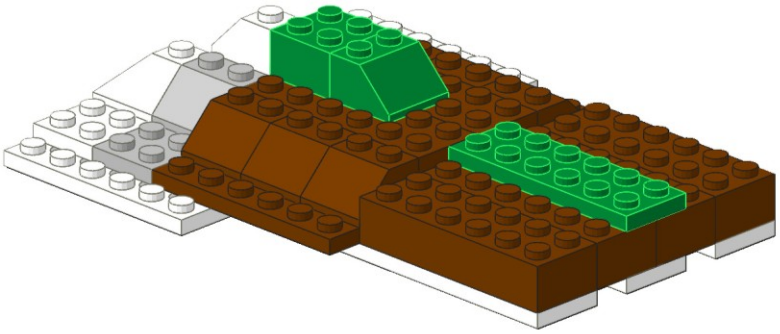

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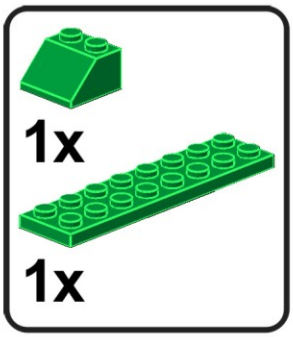
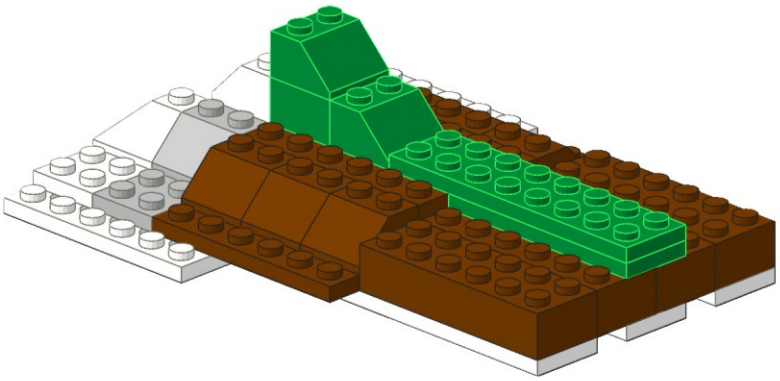
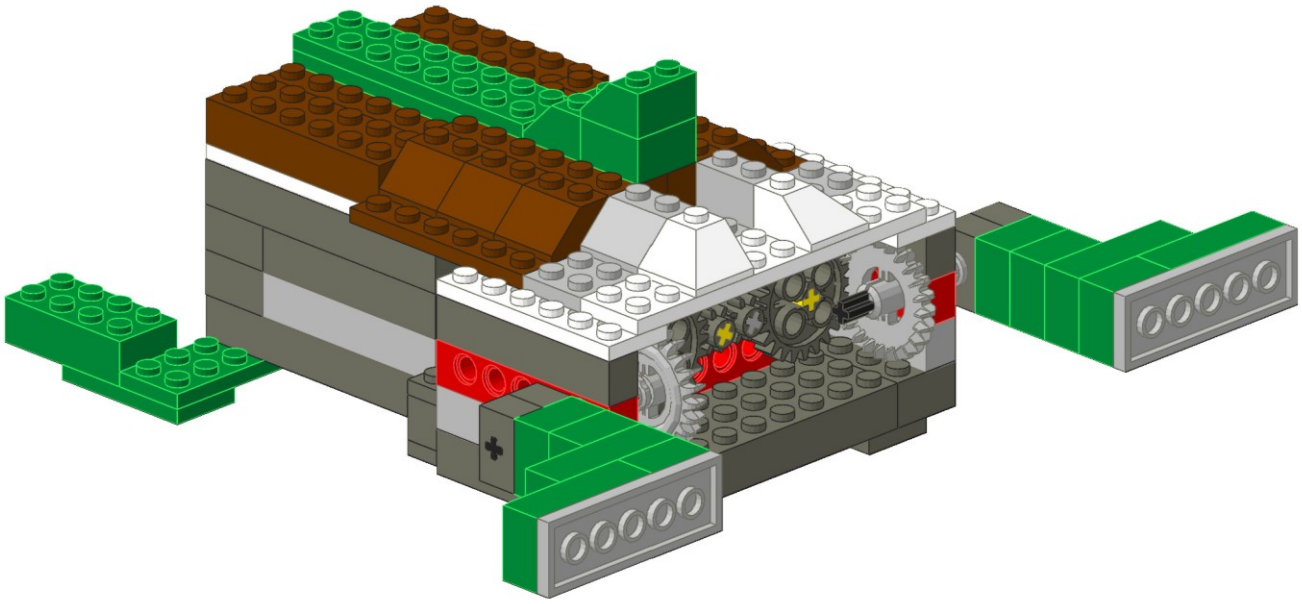
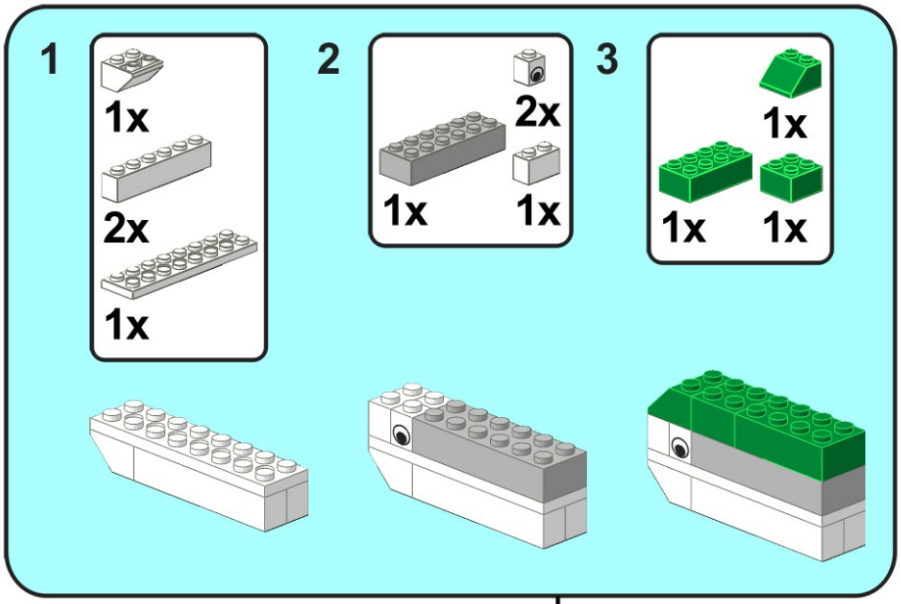
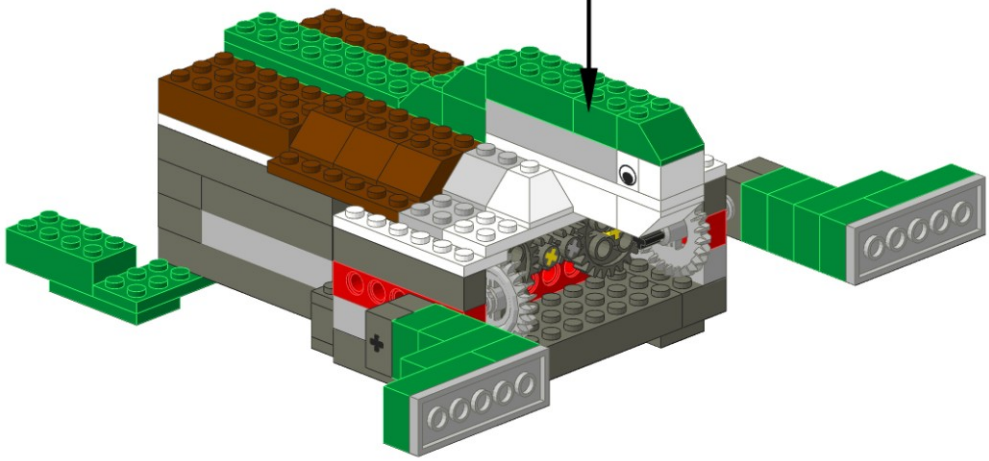




Attach the Top Shell







How to Program the Sea Turtle

The sea turtle will pull itself along a surface as long as it is not too slippery. This program spins the flippers for 5 seconds, has a rest for two seconds and then keeps going for another 5 seconds.

WeDo Backgrounds and Sounds

You can add background pictures to your WeDo programs to give your creations more life.

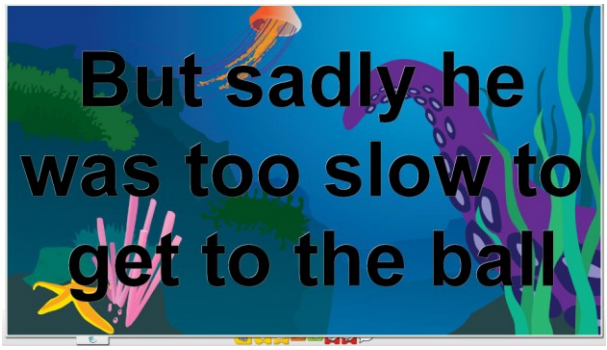
Backgrounds can be added in with the 'Display Background' icon. Changing the number attached will give different scenes. Number 8 is a nice underwater background. Try other numbers and see if you can find something useful for your story.

A narrative can also be added your background to help tell a story. Each time you use the 'Display' icon, it will replace the previous writing.

This program starts by setting a background, and then displays different parts of the story with different Display icons. The story will pause for 3 seconds (30 /10th of a second) before moving to the next piece of writing. There are four different panels in this story.

You could change the Display background at anytime to show a new scene for your story.

Here is what it will look like on your computer screen:



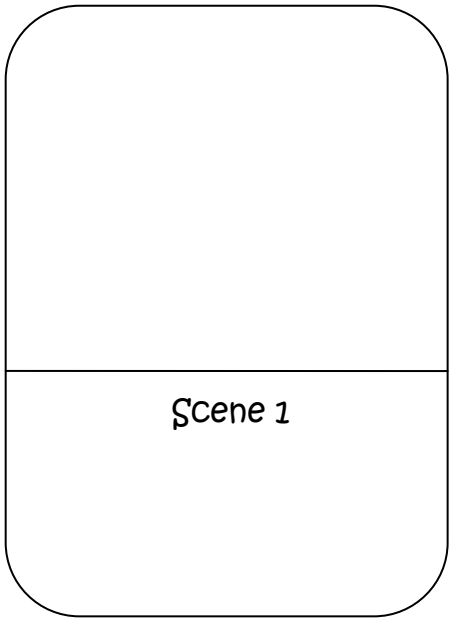
WeDo Sounds

You can also add in sounds to help your story along. The 'Play Sound' icon has 20 different sounds built-in, you just need to choose one that suits your story. Sound number 6 gives a stream of bubbles. Test out different numbers and see what sounds you get.

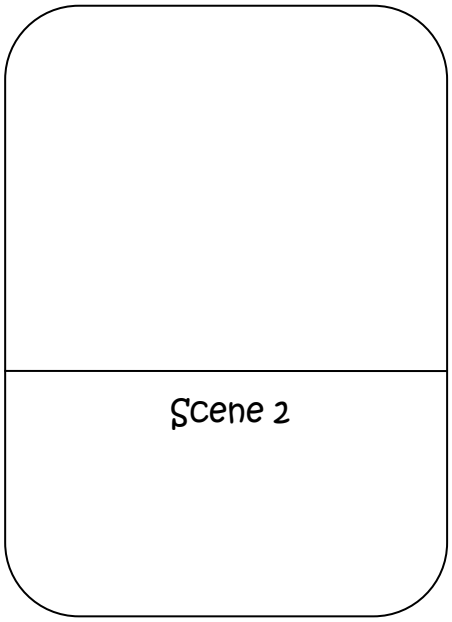
Story Board

List the Main Characters

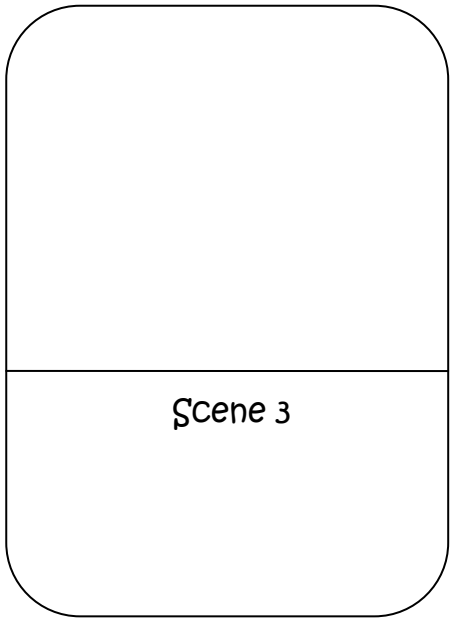
List the Main background scenes



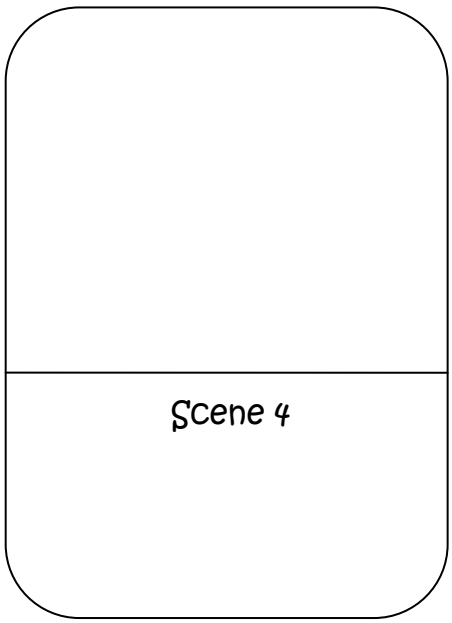
Scene 1



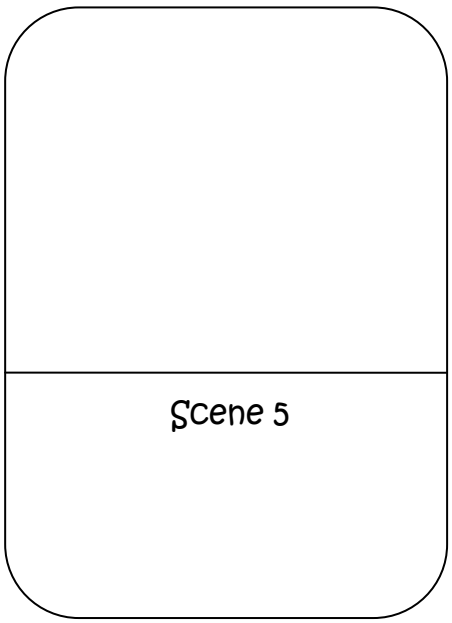
Scene 2



Scene 3



Scene 4



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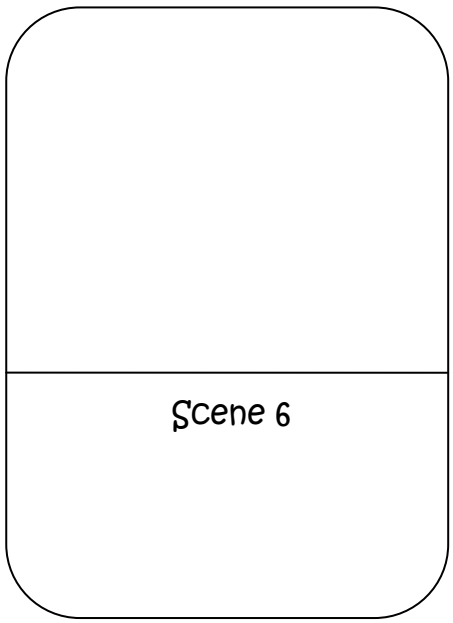


Scene 6

Coral Reef Vocabulary

Ocean, hermit crab, sea anemone, starfish, coral, snail, sea urchin, seaweed, clown fish, lion fish, sand dollar, electric eel, sea anemone, jellyfish, squid, starfish, crab, seal, dolphin, seahorse, sea turtle, dive, symmetry, limestone, protection, artificial reef, climate change, tropic, saltwater, marine reserve, coral bleaching, pollution, ecosystem

Homonyms:

sea / see

Homographs:

fish (animal) / fish (verb)
school (of fish) / school (classroom)
coral (animal) / coral (color)
marine (ocean) / Marine (military person)
urchin (sea creature) / urchin (poor child)

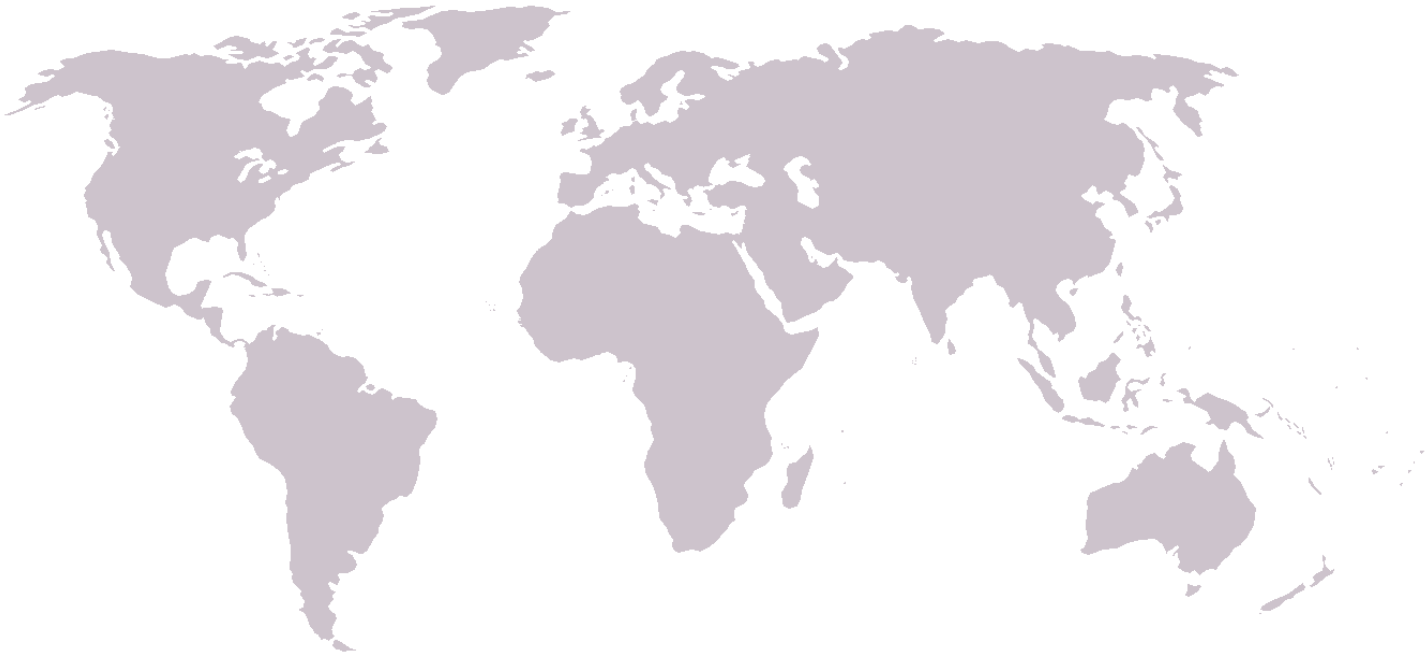
Geography:

Pacific Ocean, Atlantic Ocean, Indian Ocean, Southern (Antarctic) Ocean

These oceans are actually one global ocean.

Locations of some coral reefs—Australia, Belize, New Caledonia (South Pacific), Bahamas, Red Sea, Florida, Maldives, Indonesia

Can you mark their location on this map?



Standards relating to this Unit

NA-T.K-4.3	Designing by Visualizing and Arranging Environments for Classroom Dramatizations
NA-T.K-4.5	Researching by Finding Information to Support Classroom Dramatizations
NA-VA.K-4.2	Using Knowledge of Structures And Functions
NA-VA.K-4.5	Reflecting Upon and Assessing the Characteristics and Merits of Their Work and the Work of Others
NA-VA.K-4.6	Making Connections Between Visual Arts and Other Disciplines
NL-ENG.K-12.4	Communication Skills
NL-ENG.K-12.5	Communication Strategies
NL-ENG.K-12.6	Applying Knowledge
NL-ENG.K-12.11	Participating in Society
NM-GEO.PK-2.4	Use Visualization, Spatial Reasoning, and Geometric Modeling to Solve Problems
NM-PROB.PK-12.3	Apply and Adapt a Variety of Appropriate Strategies to Solve Problems
NM-COMM.PK-12.2	Communicate Their Mathematical Thinking Coherently and Clearly to Peers, Teachers, and Others
NM-COMM.PK-12.3	Analyze and Evaluate the Mathematical Thinking and Strategies of Others
NM-CONN.PK-12.3	Recognize and Apply Mathematics in Contexts Outside of Mathematics
NM-REP.PK-12.3	Use Representations to Model and Interpret Physical, Social, and Mathematical Phenomena
NS.K-4.5	Science and Technology
NS.K-4.6	Science in Personal and Social Perspectives
NSS-EC.K-4.2	Effective Decision Making
NSS-EC.K-4.3	Allocating Goods and Services
NSS-G.K-12.5	Environment and Society
NSS-USH.K-4.1	Living and Working Together in Families and Communities, Now and Long Ago