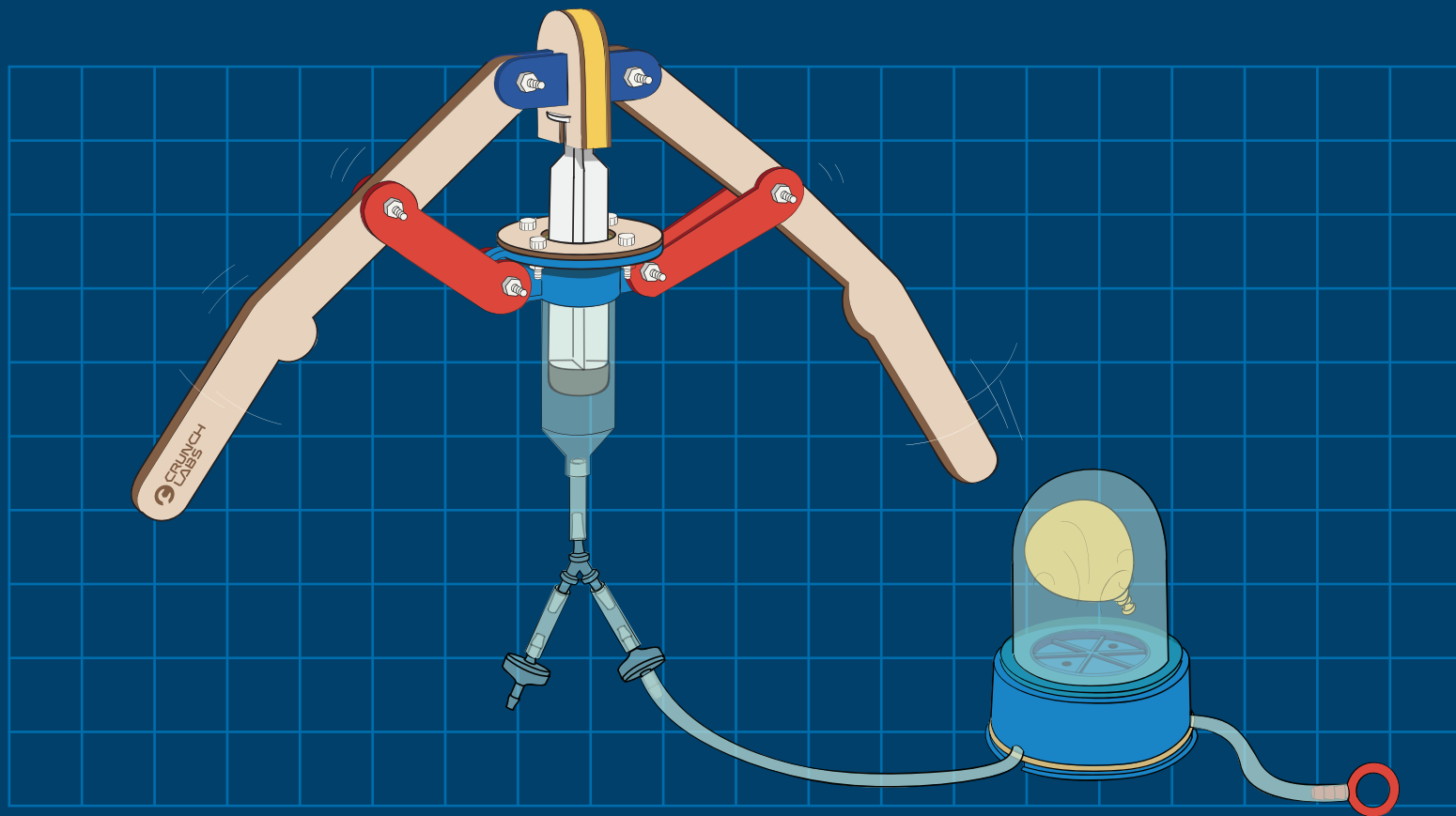




BUILD
BOX



VACUUM
CHAMBER



NEW VIDEO UNLOCKED

BUILD ALONG & LEARN WITH MARK ROBER



[CRUNCHLABS.COM/PUMP](https://crunchlabs.com/pump)

PARTS



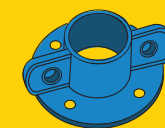
wood pieces



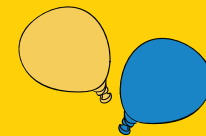
syringe



base and dome



collar



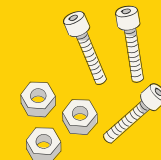
balloons



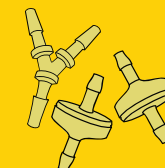
spacers



adhesive foam



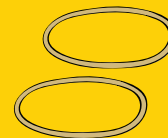
nuts and bolts



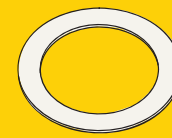
valve kit



wood wrench



rubber bands



gasket



cork



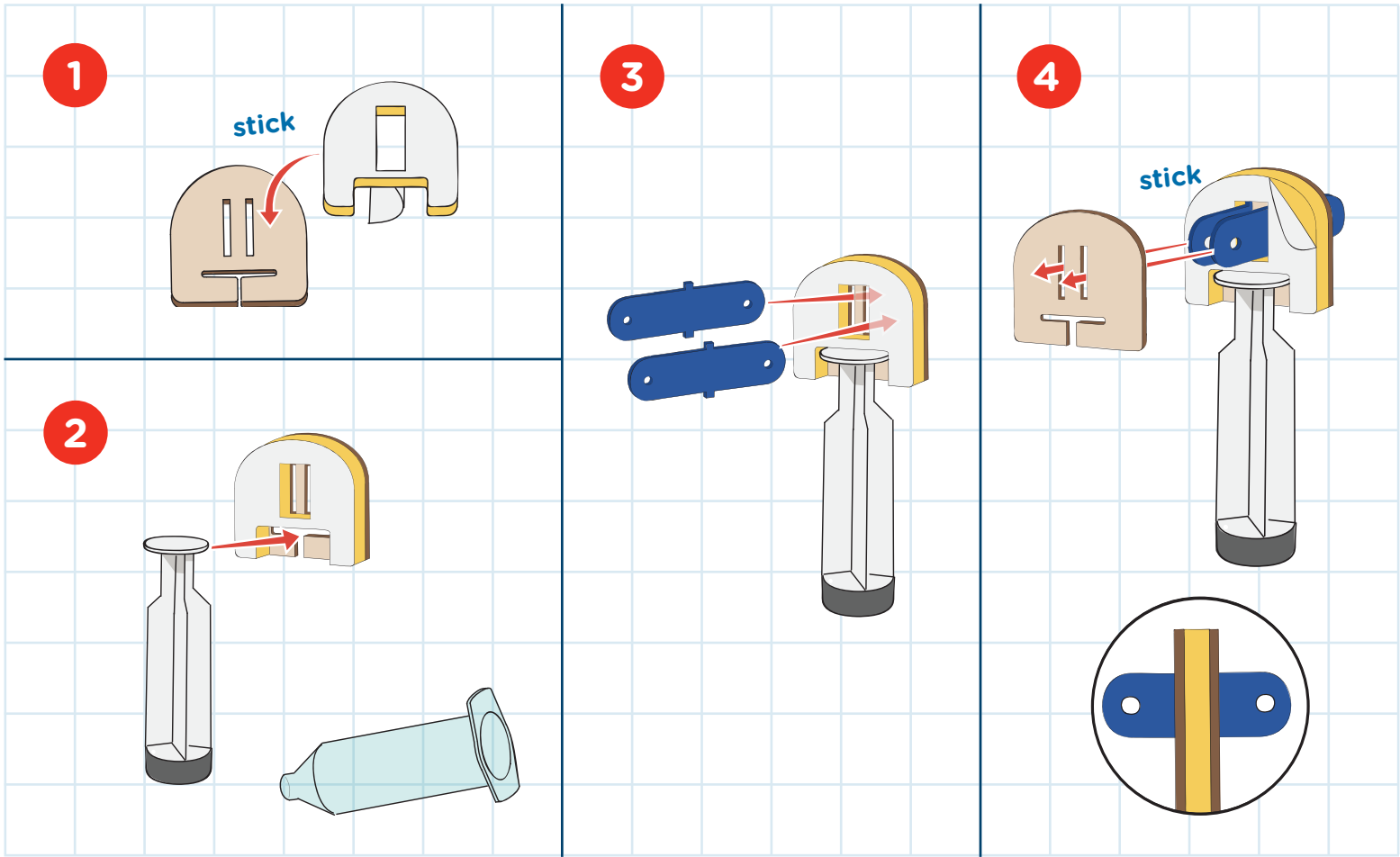
tubes



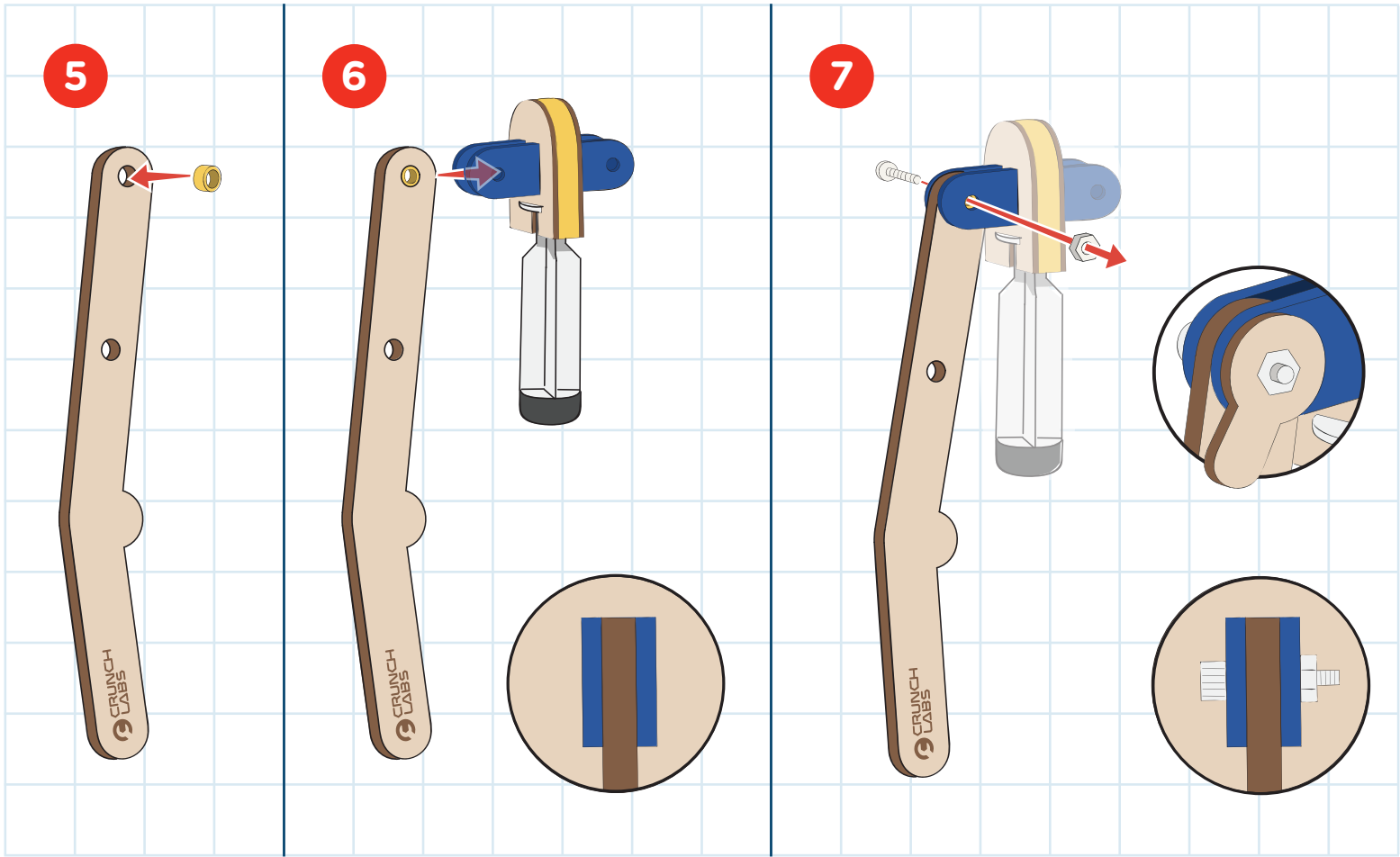
beaker

For missing and replacement parts, visit "My Account" at crunchlabs.com and we'll ship them to you for free.

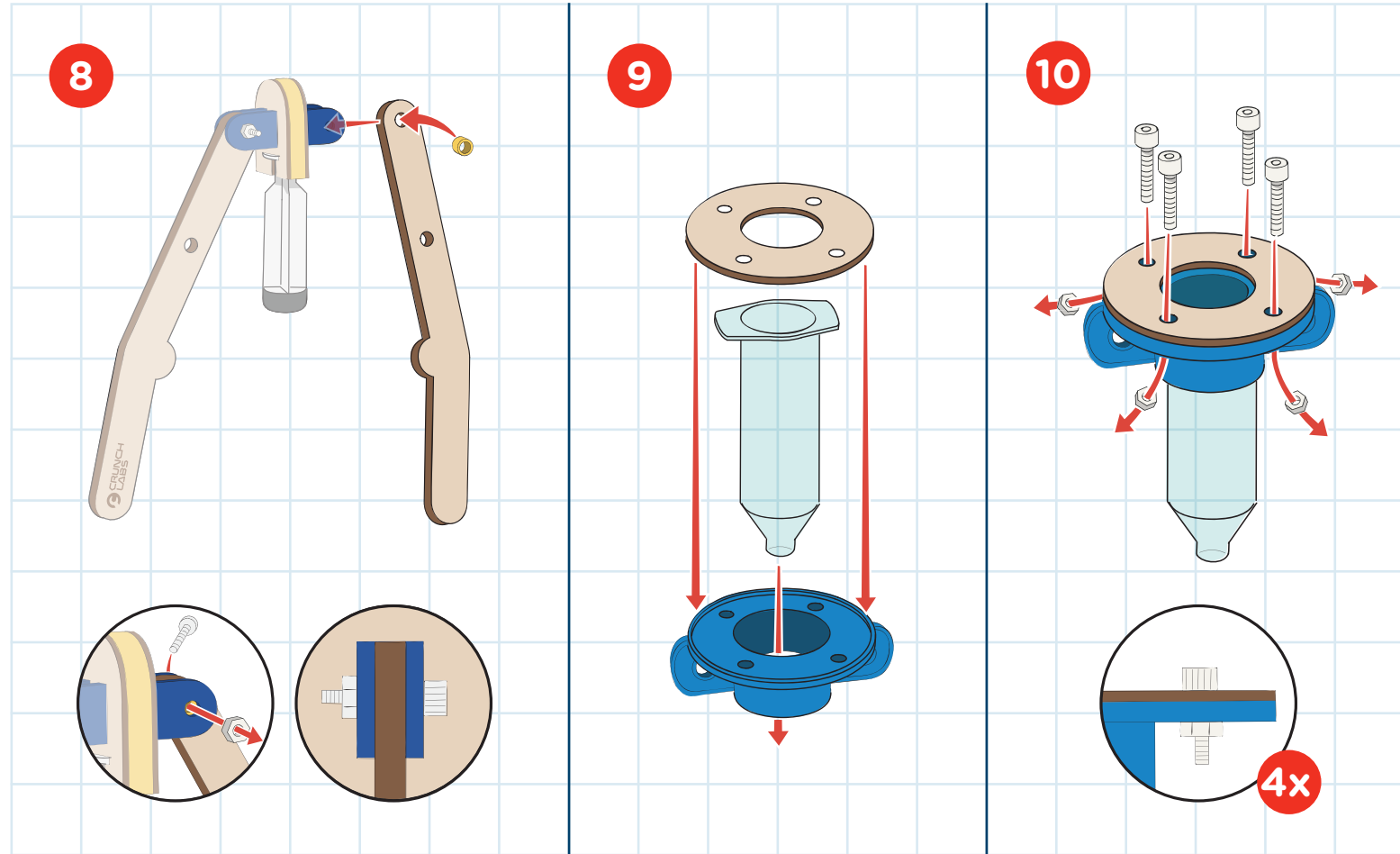
BUILD



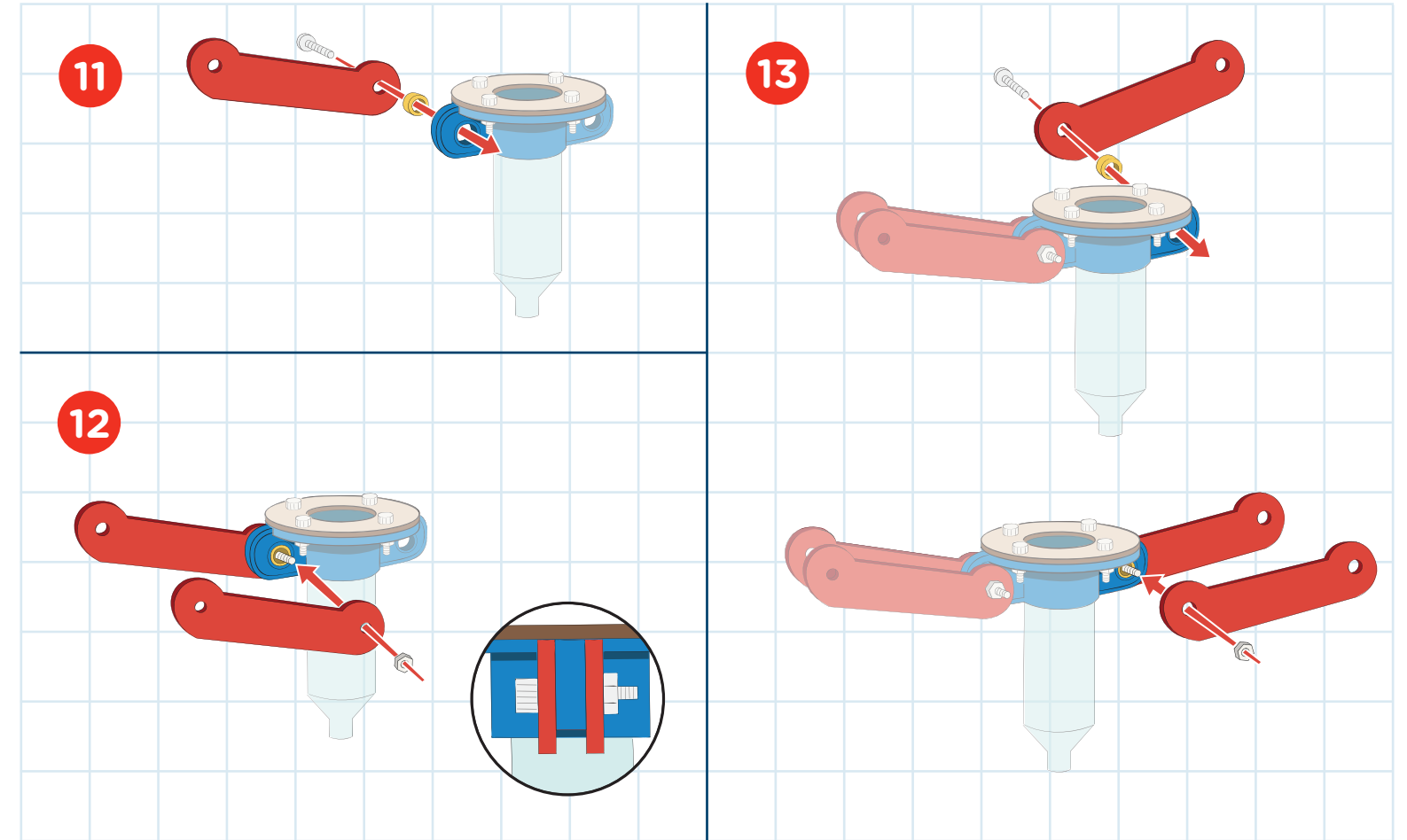
BUILD



BUILD

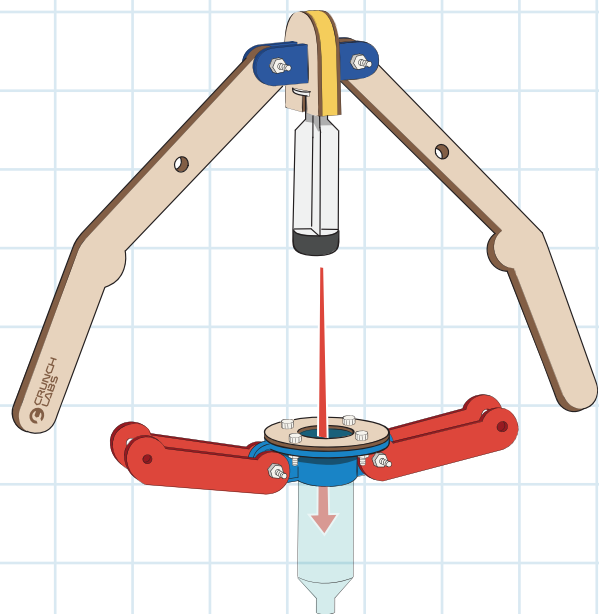


BUILD

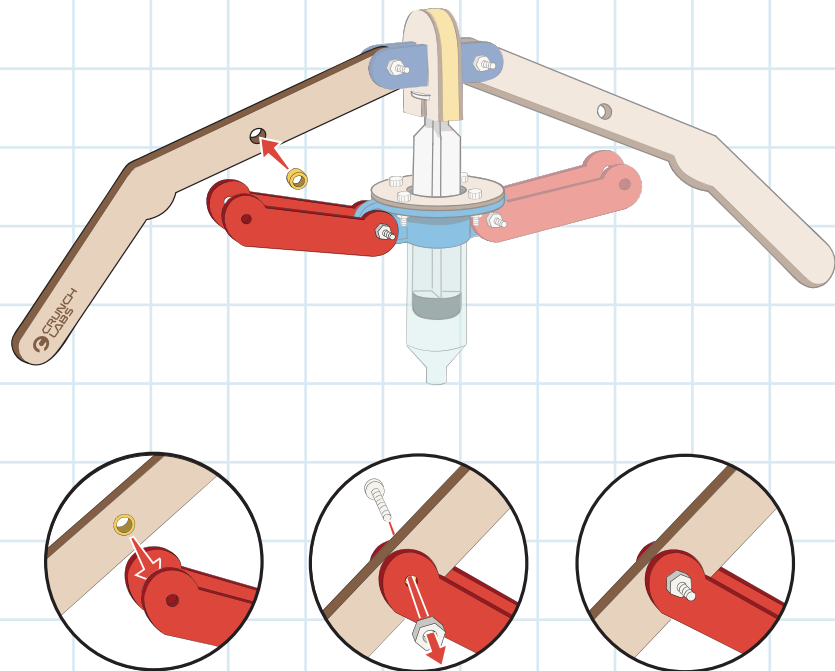


BUILD

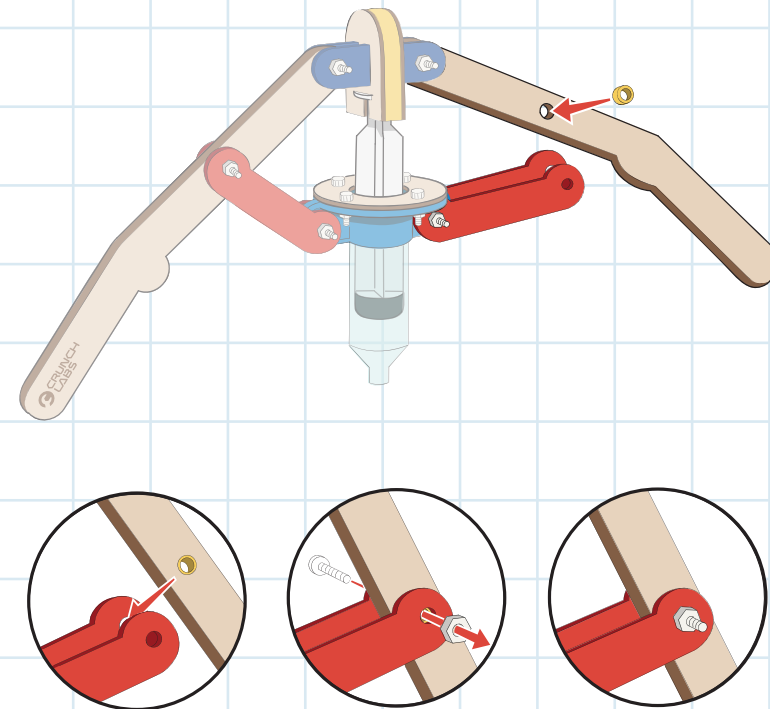
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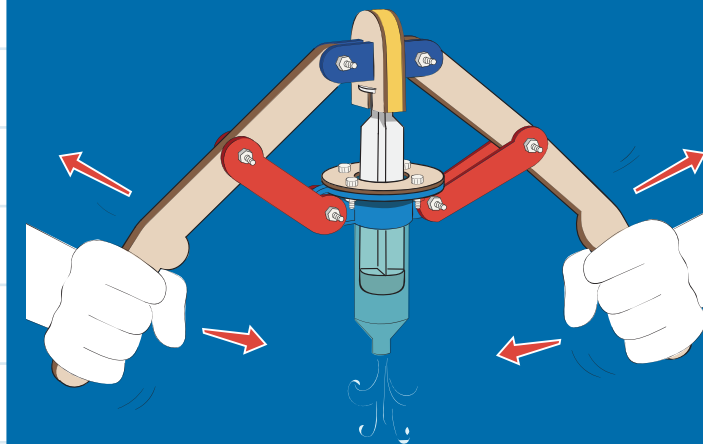
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16



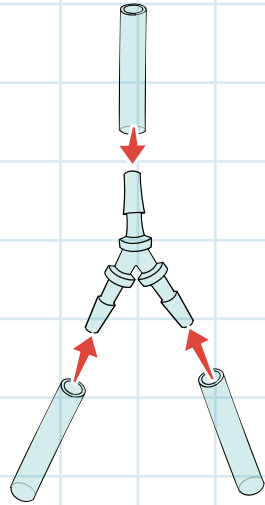
TEST



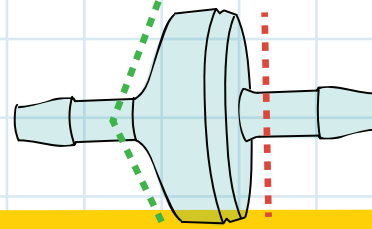
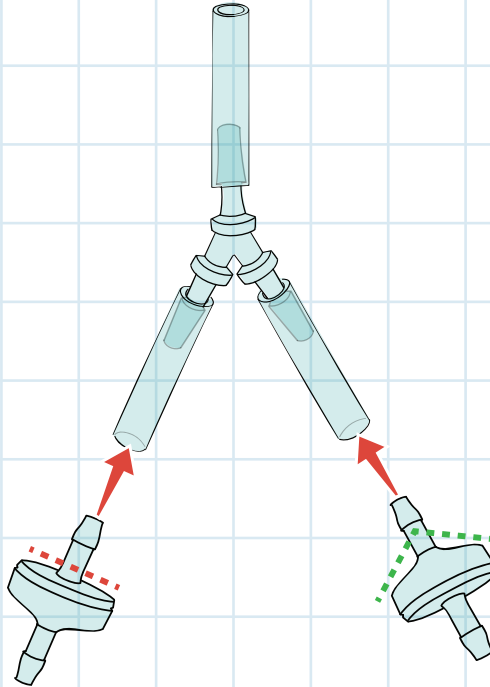
Having trouble? Watch the video at crunchlabs.com/pump

BUILD

17



18

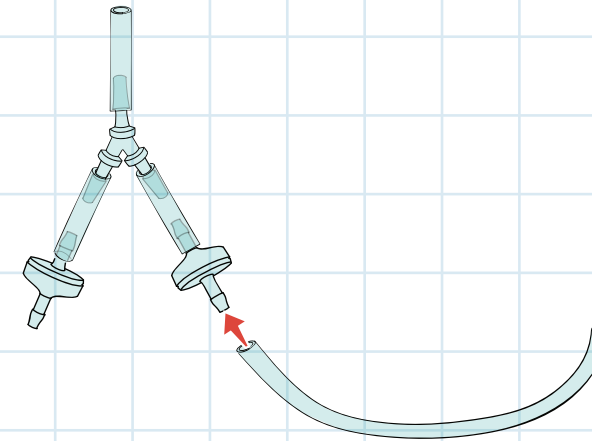


PRO TIP!

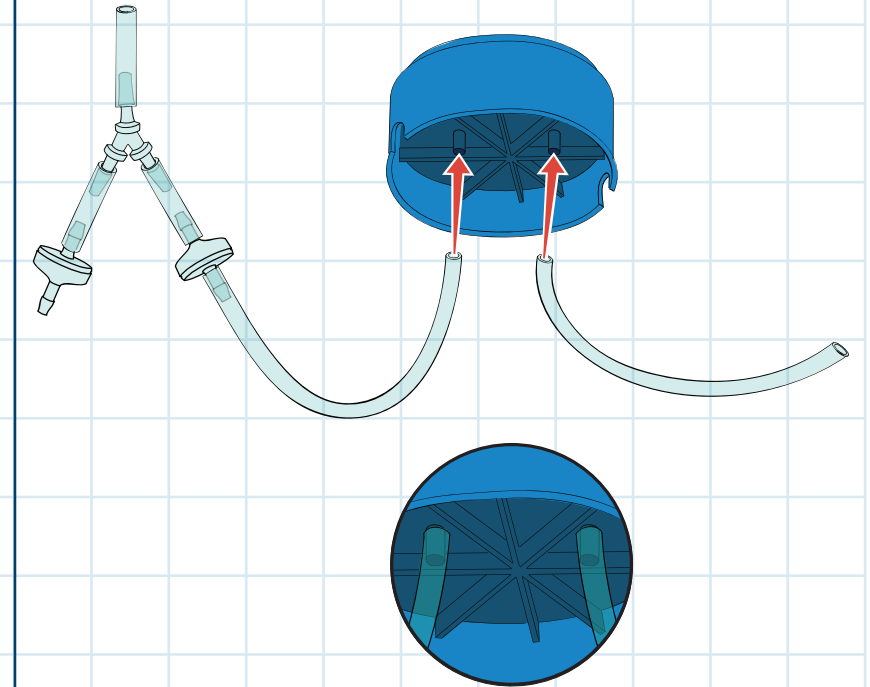
One-way valves allow fluid to pass through in **one direction** but not the other. You can discover the direction of flow by looking at the valve's body, which is shaped like an arrow.

BUILD

19

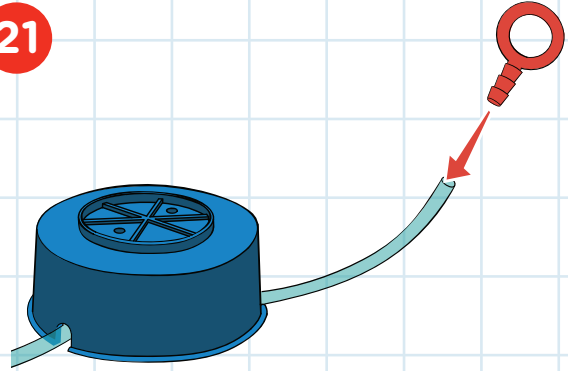


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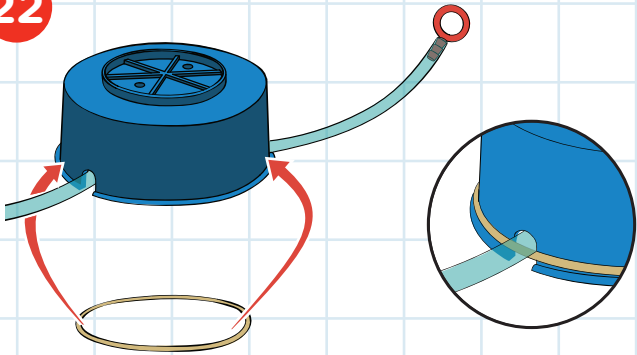


BUILD

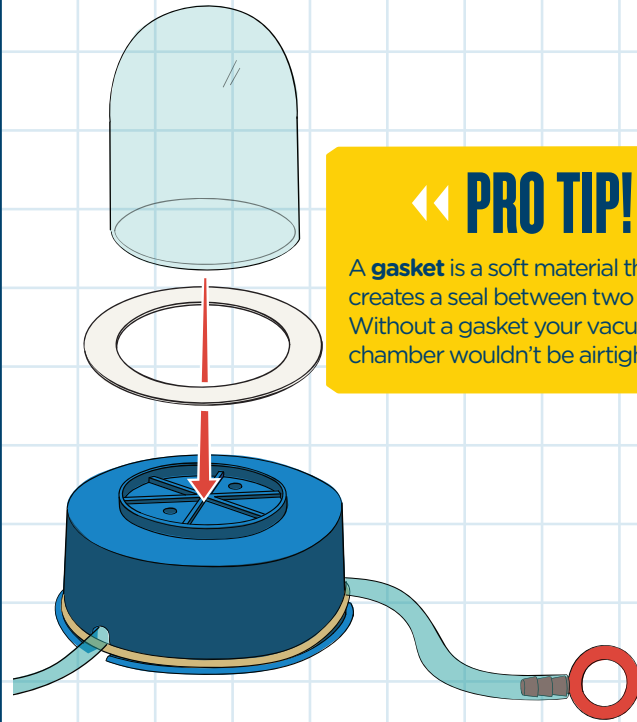
21



22



23

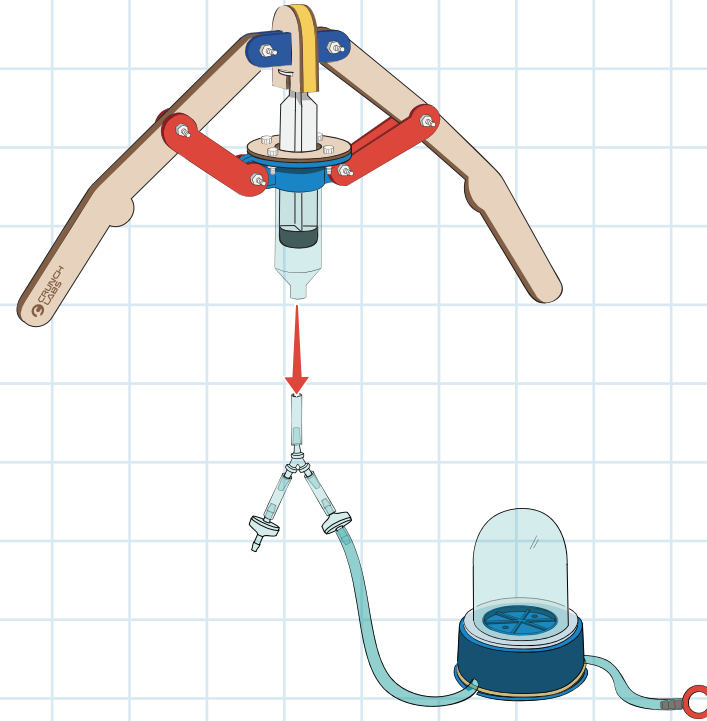


◀ **PRO TIP!**

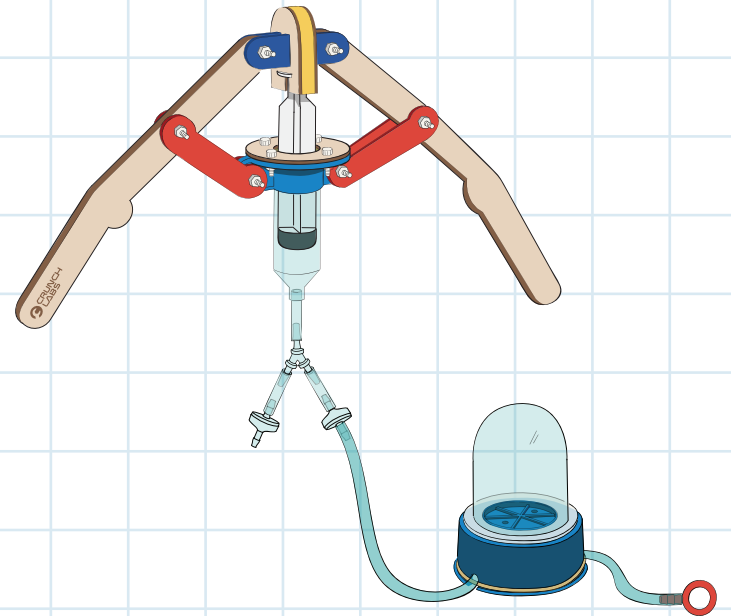
A **gasket** is a soft material that creates a seal between two objects. Without a gasket your vacuum chamber wouldn't be airtight.

BUILD

24



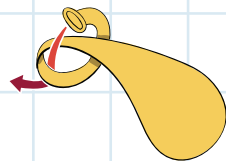
BUILT!



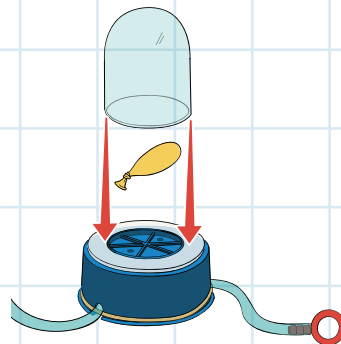
CHAMBER TEST

Time to experiment with your vacuum chamber. You can inflate a balloon without blowing and boil water without heating it up.

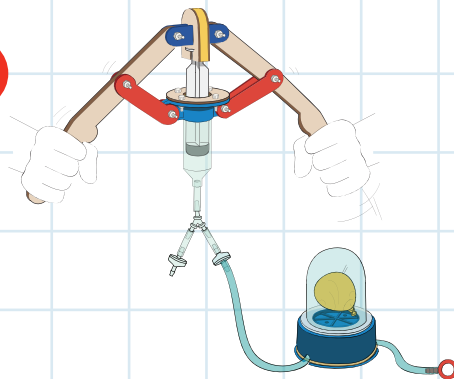
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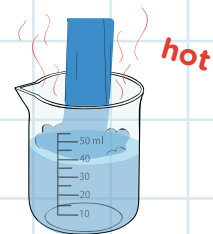
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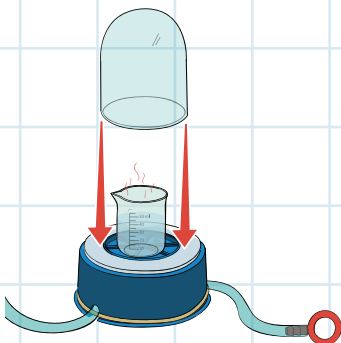
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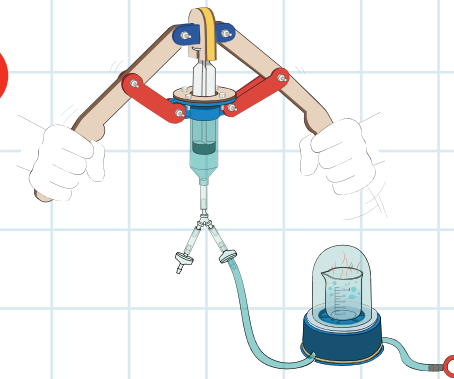
1



2



3



A vacuum is a space without matter.

Basically, it's the scientific word for "empty".

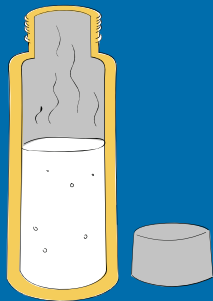
In everyday life, people use the word "empty" to describe lots of things. If you pour out a bottle of water, you might say the bottle is now "**empty**". But is it really empty? What about all the air that rushed inside? Even though you can't see it, that air is matter. If you want to make something truly "empty" you need to remove all types of matter, including air, to form a **vacuum**.



THINK

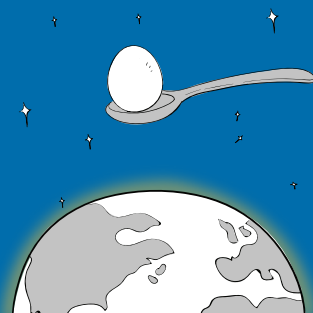
Find vacuums in other objects!

Vacuums are useful for all sorts of machines and processes. Vacuums can also occur naturally. Either way they present unique benefits and challenges.



THERMOS VACUUM

Thermoses use vacuums to help insulate liquids. Metal thermoses have outer and inner walls which form a vacuum chamber. **Vacuum chambers** make great insulators because heat can't conduct through a vacuum.



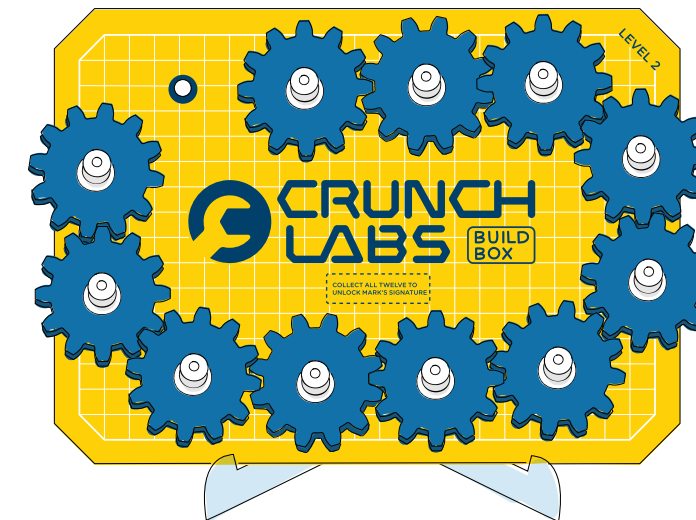
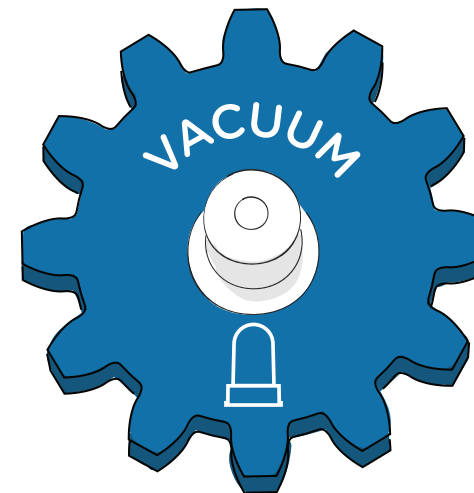
EGG DROP

Mark once dropped an egg from space! This project had unique engineering challenges because space is a **naturally-occurring vacuum**. That means certain materials like bubble wrap would pop due to the lack of atmospheric pressure.

THINK

CONGRATULATIONS!

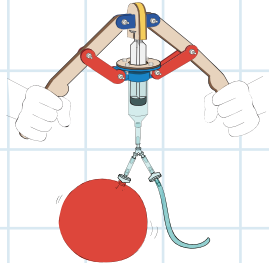
You earned a gear badge for vacuum



Don't forget to add your gear badge to your gear train!

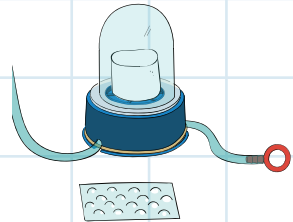
CRUNCH

It's crunch time! Use your engineering superpowers to keep building.



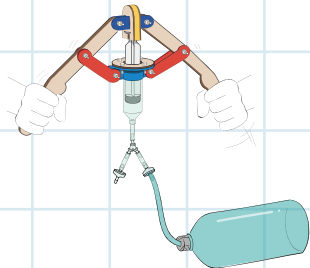
PUMP IT UP

Vacuum pumps also work as pressure pumps if you use them in reverse. If you attach a balloon to your one-way valve, you can pump it full of air!



VACUUM TEST ITEMS

Experiment with household items inside your vacuum chamber! Marshmallows and bubble wrap are fun items to start.



BIG CHAMBER

Find a large bottle or jar that you can use as a vacuum chamber. Now you can experiment on bigger items!

SHOW OFF YOUR BUILD



Share your funniest moments & coolest mods!
#crunchlabs @crunchlabs    



WARNING: CHOKING HAZARD: Children under 8 yrs can choke or suffocate on uninflated or broken balloons. Adult supervision required. Keep uninflated balloons from children. Discard broken balloons at once.
Made of natural rubber latex.

SWEEPSTAKES

Each CrunchLabs build box contains the chance to WIN a trip to visit CrunchLabs with Mark Rober! Sadly, you are not a prize winner this time. Check inside your next build box for another chance to win.

Trip includes roundtrip transportation and two (2) night's hotel accommodations for a family of four (4). Approximate value: \$4,500. NO PURCHASE NECESSARY. Open to legal U.S. residents, 18 years of age or older. Void where prohibited. For complete Official Rules, including promotion end date and information on how to obtain a free game ticket, visit www.crunchlabs.com/win.

This toy is intended for use by children over the age of eight years. These instructions contain important information, do not throw away.

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