March 2023







Reddiford Digest

How Things Work



Have you ever wanted to know more about how objects are made and work? Well this term's Science Digest is all about HOW THINGS WORK. You'll be fascinated by the different gadgets which are floating around us. They are all brilliant! No matter how small or how intriguing each device was; we really enjoyed making and testing our contraptions! So be ready for your mind to be blown, as you will soon develop a passion for design and innovation!

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Bedazzling Buoyancy

Harisiyan Sajiram and Aarav Krishnan 4S

An object floats when the buoyant and gravitational force are equal and the amount of fluid moved is equal or less than the object floating on it.

Buoyancy is an upward force pushed by the fluid on an object submerged in the fluid.

The principle of floating (figure 1) is related to the mass of the object, density of the fluid, density of the object as well as gravity and buoyancy.

Using the principles above people have built rafts and submarines. We have built a raft (figure 2) and a submarine (figure 3) to understand this principle.



How to make a bottle raft that floats

- First you take 2 bottles, 23 lollipop sticks, 4 rubber bands, weights and a hot glue gun. 1.
- Lay 11 lollipop sticks side by side. Then secure them together by adding glue to two other lollipop 2. sticks and positioning them either side of the platform.
- Take three lollipops sticks. Space them evenly so that they stretch the length of one lollipop stick. 3. Put glue at the far end of each lollipop stick. Then attach one lollipop stick to the glue.
- Put a lollipop stick on the glue and repeat step 3. 4.
- 5. Put two rubber bands on each end of both E shapes.
- Glue both E shapes to the bottom of your raft. 6.
- 7. Now you can test it !



Figure 2: Our bottle raft. This is how it looked before and after we tested to see how much mass it could support. It managed to hold 550g!!



Things you will need

- Sharp blade
- Bottle
- Balloon
- Syringe
- Tape
- Coins
- Glue
- Straw
- Tube
- Rubber Stopper

Instructions

- 1. Take an empty bottle and cut three holes on the top.
- 2. Make 4 holes at the corners of the bottom.
- 3. Put a hole in the middle of the lid.
- 4. Fix the balloon and syringe to a tube.
- 5. Using tape stick the coins on the bottle as a ballast tank.
- 6. Apply glue to your rubber stopper and put a straw on top as a cockpit.
- 7. Screw on the lid.
- 8. Test it by pushing and pulling the syringe to inflate and deflate the balloon!



technique outlined below.

How Submarines Work

A submarine (*figure 4 below*) floats or sinks by using the ballast tank. The ballast tank (*part 1 on the diagram*) can contain water to sink the submarine because water is denser than air, or it might contain air to float the submarine because air is less dense than





Figure 5: A man walking to the ballast tank inside a submarine.

5





Word search

b	ο	u	У	а	n	С	у	а	e	w	f	
f	w	k	S	f	I	ο	а	I	f	е	I	
d	а	а	f	i	S	S	v	d	s	i	0	
S	р	f	t	S	n	S	i	n	а	g	а	
i	j	k	S	е	b	k	v	s	d	h	t	
s	u	b	m	а	r	i	n	e	k	t	Ι	
b	ο	t	t	I	е	r	а	f	t	d	r	
а	b	u	0	У	Z	k	d	f	T	ο	а	
buoyancy			weight			float						
submarine			bottle raft			buoy						



Anagrams

GYRAITV -1. YISTNED -2. UIDLF SAMS Anagram Nass `**†** biulŦ 3. Answers Density 5. **Gravity** ٦'

Jokes

I used to be a fan of boats... But that ship has sailed!

Where does the boat go when it's sick ?? The dock.

What is the worst vegetable to bring on a boat?

A leek.

My dog joined the navy. Now he's a sub woofer.





On this first bage, we will be telling you all about different types of eyes!

The bulging eyes of many frogs allow them to see in front, to the sides, and partially behind them.

When a frog digests food, it pulls its eyes down into the roof of its mouth. The eyes help squeeze the food down its throat. Eyes positioned at the top of the head give frogs a vision of almost 180 degrees.



Chameleons have some of the strangest eyes on the planet, which are able to move independently of each other. This results in almost 360-degree vision! The reptile can also switch between monocular vision - when both eyes are used separately - and binocular vision, when both eyes are used to look at the same scene.



The colossal squid has the biggest eyes of an animal on Earth, measuring roughly 11 inches wide — about the size of footballs, with lenses the size of oranges. The immense squid's eyes both face forward, giving it extremely powerful vision.



The eyeball of a human weighs approximately 28 grams, and can distinguish 500 shades of grey. Sailors once thought that wearing a gold earring would improve their eyesight! People generally read 25% slower on a computer screen versus paper and males are more likely to be colour blind than females.

Fun Fact: Only % of your eyeball is exposed to the outside world, % is not exposed.



Next, a timeline and facts about the history and inventions related to the eye!

Through the years, many famous scientists have made discoveries and inventions related to the eye. These include spectacles, telescope, kaleidoscope and microscope.







On this page we will show you our spectroscope and explain how it works!

White light is a mixture of all the colours in the rainbow (red, orange, yellow, green, blue, indigo and violet), but when it reaches our eyes it appears white. The light from the torch reflects off the shiny TD, and the colours bounce off in different directions, thus creating a spectrum for us to see. If you use different light sources such as daylight or a screen, each one will create a unique spectrum.







Here are some optical illusions to get your brain thinking!

1. What is this?



3. Which step is the highest?



4. Which monster is

bigger?



2. What about this one?



0/4 –have another go

1/4 –getting there

2/4 –you are half way

3/4 –apprentice of the master

4/4 –Wizard!

Answers: 1.Two faces 2. A dog with his bone (upside down) 3.None of them, they are the same size 4. They are the same size. Measure with your fingers!

Anuradha Jayseelan and Anika Singh 5B

$\mathbf{\bigcirc}$	$\mathbf{\bigcirc}$			WHAT???
<u>C</u> R	AZY	CIRC	CUITS	
				Look at the top of the
What is a circuit?				next page to find out what this is!
A circuit is a grou	up of electrical compon	ents that work together t	to carry out specific funct	ions.
Examples of elec	trical components are:			
Motors	Buzzers	Lightbulbs	LEDs	
Resistors	Switches	Wires	Batteries	
Speakers	Alarms	ICs		
What is electricit	ty?			
Electricity is an i use electricity to working. Electric	nvisible force that trave power objects. As sociality travels from the plu	vels through lots of diffe on as the source of the e s end of a battery to the	rent things (mediums). E lectricity gets removed, f minus end using the <u>easie</u>	lectrical components the component stops
For example: the	e picture on the right	shows a diagram of a ci	rcuit. When we turn on	
turns off. This is than a motor.	b cause the electricity	finds it easier to travel	through an open switch	Battery Motor
What is a short c	ircuit?			
A short circuit is between. If a sho	s caused when electric ort circuit happens, the	ity runs from one side c re could be a fire and you	of a battery to the other could be electrocuted. If	without anything in t is not funny.
How circuits	s are <i>really</i> repr	esente <mark>d in diagra</mark>	ms.	
Components are	joined together by wir	es, but in a diagram these	e are just lines.	vitch (on) Switch (off)
Batteries are dra	wn with two unequal li	ines. The longer line show	vs the plus side. ————————————————————————————————————	-00'0-
Switches are dra connected. When	wn with two circles. V n the switch is off they	When the switch is on, the are not connected.	ne two circles are	Buzzer
Motors are circle	es with M in them. Coul	d it be more obvious wha	at it is?	
sounds like a lot	of Mumbo Jumbo until	you see what it is.		LED
LEDs are interest	ting. They are interest	ing because E ectricity ca	an only travel through	
them in one dire	ction—the electricity h	as to go through the tria	ngle first. Now do you	
see why you nee	d to know which way e	lectricity travels?		

A bulb is a circle with an X. That is simpler than an IC (Integrated circuit). If you really want to see, then it is right by the title, but it is not pretty. It looks EXTREMELY intimidating.

B)







1



Bulb

 $\mathbf{\hat{x}}$

Now, you may be saying, "Well that's cool, but what is the point? Why is this important?"

You are probably good enough to be part of the NASA rocket builders What are rockets made of? You guessed it! Lots of components and circuits. If you don't learn circuit notation, you won't be able to share your ideas with fellow engineers. They will help to make sure the rocket is safe and does not explode.

Is there a short circuit?

Check if each circuit is safe or is there a short circuit which has a danger of exploding.









Find them in the wordsearch! Some are hidden diagonally. TRICUI CIECTVIETRI TTEYBRA REWI ZEZBRU LBGHTULBI ORSITRSE TRMOO	HAT AM I?	 W F G H Y Z H Y A W A A W E W A B A A<	I A S C R V A R F	C R T B L C C E E S K E U L E B U T D H L	J (1) U (1) T (1) U (1) C (1) C (1) (1) (1) (1) (1) (1) (1) (1)	0 E 1 T 1 T 1 T 2 E 3 Y 2 E 3 X	B N O I R K S C R R R R	E G R E S I S T O R E
I provide power to circuits, sometimes less, sometimes I help you see, light radiates out of me. What am I? I am feared all over, even by engineers. I happen when between. What am I? Answer Ans	wore. What am !? electricity comes from one si lightbulb Short Circuit R R O R C C C C C C C C C C C C C C C C	ide of a bar	ttery to	the oth	er with 1 1 1 2 1 3 2 4 7 4 7 5 2 1 7 5 2 5 2 5 2 5 2 5 2 5 2 5 2 5 2	nothin	g in A L I S S	4

A Brief Guide Jo Brilliant Bridges By Akshayen Sajiram and Aari Malde

Bridges are a basic part of travelling, whether it be across seas or through forests. Originally made from wooden planks attached to ropes, they were considered to be dangerously unstable. Nowadays, bridges are made from metals and other sturdy materials and are used by people travelling in vehicles or trains to cross over wide open spaces. There are several types of bridges, including arch, cable stayed and beam. However, today we will inform you about both suspension bridges & drawbridges.

<u> Prawbridaes</u>

Drawbridges come in various shapes, sizes and types depending upon their use.

However, all of them have moving parts that can be either lifted, rotated or swung so that things (mostly vehicles) can cross. Where did drawbridges come from?

One of the earliest uses of drawbridges, originating from medieval Europe, (see Fig 1) was to defend castles. It did this by stopping enemies from crossing a moat (the round body of water, usually surrounding a castle or fortress) whilst still allowing the allies to cross. The reason it had this extraordinary ability was because it had the ability to rise and fall.



The main type of drawbridge is called a bascule drawbridge. These function through the use of counterweights (a weight that applies an opposite force in order to keep balance and stability in a mechanical system), either mechanical or hydraulic (relating to a liquid moving in a confined space under pressure).

Because of the fact it is built on water, it is usually inevitable that ships have to pass through. When this occurs, the operator activates the system and allows the two halves of the bridge (the leaves, see Fig.2) to rise. When the boat has passed the leaves set down, and traffic rolls across once more.



Fig 2.- A drawbridge letting a ship pass

ame

Leonardo Da Vinci



Known for Inventing the first Hydraulic Drawbridge.



Hall



Known for designing Tower Bridge, London.



Paul Philippe Cret



Known for designing the world's longest double leaved drawbridge, at 109m, Market Street Bridge, USA.

DIY: Make Your Own Hydraulic Draw Bridge

Ω

Items Required:

- Ω A large piece of cardboard (preferably **thin**)
- Ω Scissors or a sharp blade (adult assistance is **required**)
- Ω Superglue/glue gun
- Ω 2 pieces of tubing (each around 30-45cm)
- Ω 4 10ml syringes

STEP 1- Cut out 4 trapeziums that are 18x2cm as shown on the right.

STEP 2– Cut out the shapes shown to the right. (Note that the diagonal lines are 6cm

STEP \mathcal{E} – Using the trapeziums in step 1 stick them onto the second shape you made as shown.

STEP 4— Cut out shape A with the dimensions 9cmx8cm. Then cut out 2 shape Bs which have the dimensions 1cm x 9cm. Then cut out two shape Cs from the yellow card that measure 0.25cm x 9cm. Finally cut out two shape Ds from the cardboard with the measurements 0.5cm x 9cm.

STEP 5-Using the picture shown as a guide, stick the shapes made in step four together.

STEP C- Using the picture shown, carefully make a hole 7.5cm in and 3.5cm in and 2.5cm down from the top edge. Do this with both of the shapes made in step 3.

STEP 7– Using hot glue, stick the shape made in step 5 onto the shape in step 6. Make sure to stick it just above the hole you made, using the pictures to help. Then stick the model to the other side.

STEP E- Encase the skewer stick (adjust to fit) in a straw and pull through the top hole. Then, using hot glue stick a circle on either side of the holes, covering up the sticks. Repeat for the bottom hole.

- Ω Blue tissue paper
- Ω Paint
 - Yellow card
- Ω Drinking straws and skewer sticks

18



3.5

90

9cm

B

0.5cm

0.25cm

1cm

8

Δ

9cm

N

311

5

D

5

DIY: Make Your Own Hydraulic Draw Bridge

Items Required:

- Ω A large piece of cardboard (preferably **thin**)
- Ω Scissors or a sharp blade (adult assistance is **required**)
- Ω Superglue/glue gun
- Ω 2 pieces of Tubing (each around 30-45cm)
- Ω 4 10ml syringes

STEP Σ - Repeat Step 4 but instead of using 9cm use 12cm, as shown. For example, Shape A in step 4 now has the measurements of 8cm x 12cm.

Then assemble the pieces, using glue, together. Use the second picture (far right) as a reference.

STEP 10 – Cut 2.5cm of skewer stick and 2.1cm of straw. Then cut out 2 2cm x 2cm squares and poke a hole in the centre of each. Encase the skewer stick with the straw. Then put each square on each side of the stick reinforce with glue.

Then, stick this model onto the piece made in step five, 3-5 cm in. Use the pictures as reference.

STEP 11- Glue the top of the syringe to the straw. Then glue the edge closest to the syringe to the straw on the top hole as shown. Then, just above the tip of the syringe glue it to the straw as shown on the far right.

STEP 12 – Take an 8cm x 1.5cm length of cardboard and slip it in between the 2 sides. Reinforce with glue.

STEP 12 – Fill up a syringe with water and connect the tubing to both syringes, one with water and the one on

STEP 14 — Repeat steps 1·13 to make the other half STEP 15 – Glue each side to a cardboard base. Finally paint your model.

STEP 1ϵ - Scrunch up the tissue paper then unfold and place so that it looks like a river or another waterbody.

- Ω Blue tissue paper
- Ω Paint
- Ω Yellow card

12 CM

TABLE .

 Ω Drinking straw and skewer stick

12 cm

Here's one I made earlier.

How to use it— Push the loose syringes to make the bridge go up. Push until you reach a 45-60° angle or until you feel a resistance. To lower the leaves pull until you feel a resistance.

SUSPENSION BRIDGE

Hello and today you are going to learn everything about a suspension bridge and how to make one!

Suspension bridges get their name from the fact, that the roadway is suspended by cables from two tall towers. In the suspension bridge, the roadway hangs from strong wires called cables. The main cables hang between two or more towers. Smaller cables hang down from the main cables. The smaller cables hold up the roadway.

Sometimes it can be aesthetically pleasing like in this picture. It is like this so it attracts attention which personally I think is crazy!!!



The incredible scientist who first created suspension bridges in the 19th century was John Roebling, who was from Germany and lived for 63 years.

SUSPENSION BRIDGE

Now we will start to build our own suspension

bridge! First step is to gather the following items:

- 4 toothpaste boxes
- 4 lolly sticks
- 4 red pieces of paper
- 2 pieces of cardboard 15cm by 21cm
- 2 pieces of cardboard 4cm by 4cm 3 pieces of cardboard 19cm by 4cm Masking tape Some string and glue
- 1. Cover your two toothpaste boxes in red paper. Use a lolly stick to connect the two boxes together at the top with glue. Do the same thing with your other lolly stick and stick it onto the bottom of the boxes.
- 2. Paint the 19cm by 4 cm piece of cardboard like a road. First cut the masking tape into little bits which are about 4 by 1 cm strips. Then paint it all black. Put the strips of masking tape onto the road separated from each other they should be in line in the middle of the road. Glue the ends of each road from underneath and then stick each end onto the 15cm by 21cm piece of cardboard onto the road.
- 3. Make an open box with the rest of the cardboard. How to make the open box; two of the 19cm by 4cm pieces of cardboard are vertically stuck onto each end of the other 19cm by 4cm cardboard. Then on the edge of the 19cm by 4cm cardboard which are vertical, put the 4 cm by 4cm pieces of cardboard there and you can stick all of this with glue and masking tape.
- 4. Now with the pieces created you need to put them together. First with the 2 open boxes put them underneath the road so the open side is on the ground and make sure they are spaced out a lot. On top of the ends of the open boxes where it sticks out, stick the red posts on.
- 5. Finally add strings; add a long piece of string from one end of the post to the other end for both posts. From that long one glue other smaller string onto it with the other end of the string underneath the road. Now we are done!







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Electronic Musical Instruments

What is an electronic musical instrument?

An electronic musical instrument is a musical instrument which produces sound through electricity.

Electric Guitars

Magnetic pickups inside electric guitars detect magnetic flux as the strings are played and convert this into electrical signals which are sent to an amplifier which then converts it back into sound.

Electric Piano Pressing the keys on a piano causes mechanical hammers to strike metal strings or metal reeds. This causes vibrations which are then converted in to electrical signals by magnetic pick-ups and connected to an amplifier to make sound loud enough to be heard.

Electrical Drums

Each drum pad has sensors that generate an electric signal when struck. This is transmitted through cables to a synthesizer which then produces sound.



The History of Electrical Musical Instruments

• Electricity has been used since the 1700s experimentally with acoustic instruments, however none were properly developed or recognised as musical instruments.

The first Electrical keyboard was invented by <u>Dr Elisha Gray</u> in 1874 who was experimenting with telegraphic and communication technology. However this has never been recognised as the first musical instrument either!

In 1936 a jazz guitarist, <u>Charlie Christian</u> developed the first electric guitar, and in 1937 G. D. Beauchamp patented the first electric guitar which was known as the *Rickenbacker Frying Pan*.



Leo Theremin

This Russian scientist developed the <u>first</u> recognised electrical musical instrument in 1920.

A <u>Theremin</u> creates an electric field around two antennae. A vertical antenna controls pitch, and a looped antenna controls the volume. It detects air movement around the antenna created by the movements of the musicians hands.



How I Made an Electric Guitar

The electric guitar has a body and a fret board. I used an old frying pan and the base of a flowerpot for the body and a long piece of wood for the fretboard. These had to be joined together to make the guitar. But before that I had to cut the wood, smooth it, and shape it using an electric sander. All the pieces were joined together using screws and pieces of wood. The tricky bit was trying to get the strings over the body but not too close or too far which would allow them to be plucked and picked up by the transducer. Brackets had to be made out of metal and manually bent and cut using an angle grinder to hold the strings in the correct position. Once everything was in place (after a few days of hard work in the shed), I decorated the guitar using a pyrography pen! The electric guitar does work but lacks the magnetic pick-ups. This is my next challenge for the summer holidays!!

0

ANAGRAMS AND FUN FACTS!

- 1.Celetirc
- 2.Nimereht
- 3.Barkoyed
- 4.Fapmilrei
- 5.Nclerotheepo

Did you know a laser harp uses a laser light display interface to produce sound? When the musician blocks a laser beam with his hand it produces sound with a visual display.





Did you know the Theremin was used in the soundtracks of blockbuster movies such as "Mars Attacks!", "The Day the Earth Stood Still", and "Spellbound"? It was also used by the Beach Boys in their hit single "Good Vibrations".

By Khai Shah 6S



The Big Bang Theory! By Kishan Gudka and Aarav Singh 5G

We hope you enjoy learning about The Big Bang Theory because in this article there are fun facts, a poem and some puzzles and quizzes.

The Short Answer

The big bang theory is how scientists believe the universe began and grew. It's the idea about how the universe started, expanded and evolved. The universe is very big and still expanding but have you ever wondered how it began. Every speck of energy closed into one point and then exploded!

What's the Big Bang All About?

In 1927 an astronomer named Georges Lemaitre had a big idea. He said that a very long time ago, the universe started as just a single point. He said the universe stretched and expanded to get as big as it is now, and that it could keep on stretching.



<u>Georges</u> Lemaitre

Georges Lemaitre was a mathematician and cosmologist. He established that the universe is expanding because space is stretching, producing red-shifts in light arriving from distant galaxies. He was the first person to derive Hubble's law.



Lemaitre was also the first scientist to propose that the universe and time itself began in a single instant. He advanced the theory of an explosion later on known as the Big Bang. His work indicated that the universe has a definite age.

In it, he proposed and described his theory of an expanding universe. Using Einstein's theory of relativity as a guide, Lemaitre speculated that space is constantly expanding and, therefore, the distance between galaxies is also increasing.

Big Bang!

It makes me dizzy when I think About how life began Some people think it started With a big almighty BANG!

Out of a tiny pin-head Came everything we see The moon, the planets and the sun The Earth, the sky and sea.

I find this makes my head go WH00SH But what makes me feel worse Is when they say that from that dot Sprung our great Universe.

But how did all of space and time Come out of just a dot? They must have squeezed and squashed them down Then tied them with a knot.

> Okay so let's imagine now This dot blew like a bomb It spat the Universe right out BUT... Where did that dot come from?



Big Bang Quiz

1. What happened during the Big Bang? **EXPLOSION AND EXPANSION OF A SINGLE POINT** 2. How fast did the expansion occur? WITHIN THREE SECONDS 3. What do scientists think the Big Bang was? THE WAY THE UNIVERSE BEGAN 4. Who was the first person to come up with Hubble's law? **GEORGES LEMAITRE** 5. Fill in the blank: The universe was as small as a _____ head PIN 6. True or False: Scientists have figured out how the Big Bang works. FALSE 27

FANTASTIC FLYING

Have you ever wondered how aeroplanes are able to fly? Well, this topic is, lets say, a little complex but we will try to simplify it to the most succinct (yet chatty) explanation! Well, let's get to the basics!

People have been trying for ages to come up with reasonable and stable flying objects, yet it wasn't until 1903 when the Wright Brothers flew the first power controlled machine known as the Wright Flyer. This created the road map to the



You will first need to know the parts of the aeroplane:

There are many components that make up an aeroplane. The plane's body, or fuselage, holds the aircraft together, with pilots sitting at the front of the fuselage; passengers and cargo are in the back. It works by using the rotor and a series of pistons and tricky engines – it's a lot to get around!

The rudder may seem pretty useless. However, the rudder can be used rather effectively to steer the wheel – bet you didn't know that! It can also be used like as a speed gatherer, to cut away the air resistance.

The primary difference between early powered aircrafts and modern conventional planes can be seen in the wing design. Early airplanes featured thin, flat wings inspired by insects, however modern aircrafts feature a curved shape that helps to create a higher pressure of airflow under the wing, thus helping to produce lift.

Do you know cars have their engine at the front, and super cars have their engine at the back? Well, aeroplanes don't have it at either place: they actually have it in their pods under the wings to generate thrust to lift the plane into the sky. There were many famous pioneer of the modern planes and

We're going to tell you about a few of them...



The two Wright brothers Orville Wright and Wilbur Wright were American aviation pilots credited for the building and flying of the first motor aeroplanes. They were said to be the pioneers of motor in flying objects. The plane was in the air for several hundred metres before it crash landed.

Hundreds of years ago, before Orville and Wilbur Wright invented the first motor planes, Leonardo da Vinci brought up the idea of transport through air with his Ornithopter.

Lawrence Burst Sperry was the first to introduce autopilot berson to aeroplanes. He was one important figure as without him pilots when flying planes in the night would have to stay awake all night! Did you know that even now most aviation aeroplanes have a 30 or 40 year old autopilot.

Admiring the Wright brothers Neil Armstrong grew up to become a famous aeronautical engineer (an engineer of aircraft). After contributing to the construction of the Apollo 11 space shuttle, he mounted the famous mission to land on the moon in 1969.

Not all flying is done in the Earth's atmosphere. As the world is advancing, aeronautical engineers are advancing into space and trying to develop space travel to Mars.



Although many people feel that the **Wright Brothers** were the first to invent a plane, it was actually **Henri Giffard**. 50 years before he invented the blimp looking plane which flew 15 miles!



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These are your tokens, you can use some of your own but you'll need a die. The aim of the game is to reach to 100.

If you land on a rocket then move forward ten squares, if you are at 91+ then move 5 places. If you reach 95+ then it doesn't apply.

If you land on the question mark then invert you number e.g. 81 is 18 and 45 is 54. But if you bang into a plane explosion then you and your partner(s) should immediately swap positions of your tokens on the board.

If you land on a bang you have to start again! However, if you reach the jet pack then go to double the number!