

## MANAGING OUR NEED FOR SPEED (LEVEL 2)

<b>Description</b>	Learners will explore the theme of transportation with vehicles in the sea, land and air. Learners will explore how vehicles move and related regulations, before making their own dream vehicle.
<b>Leading Question</b>	What's the fastest vehicle that you can make?
<b>Total Time Required</b>	5 hours over 5 days
<b>Supplies Required</b>	Tub, Water, Paper, Tube and other scrap material, paper, papers of different densities (if available)
<b>Learning Outcomes</b>	<ol style="list-style-type: none"> <li>1. Grasping the concepts of gravity, force, motion, sinking-floating, resistance, wind.</li> <li>2. Making hypothesis and test these through experiments</li> <li>3. Analyze data to determine if a design solution work as intended</li> <li>4. Understanding the importance of transportation safety rules and regulations and related professions</li> </ol>
<b>Previous Learning</b>	Familiarity with conducting science experiments and writing about them

### DAY 1

Today you will explore different vehicles and transportation regulations.

<b>Suggested Duration</b>	<b>Activity and Description</b>
<b>10 minutes</b>	<ul style="list-style-type: none"> <li>● Illustrate and label different ways that they can use to get to different places e.g. cycling, rickshaw, car, bike, boats etc.</li> <li>● Once you have brainstormed, think of ways of grouping these forms of getting from one place to another one.</li> </ul>
<b>5 minutes</b>	<ul style="list-style-type: none"> <li>● One possible grouping is related to the element on which they move: air, water, or land.</li> <li>● Make a list with all the air vehicles you know.</li> <li>● Draw and write all the reasons people would use air vehicles e.g. to travel to another country, to go to the moon / space, for surveillance, to deliver emergency posts etc.</li> </ul>

**15 minutes**

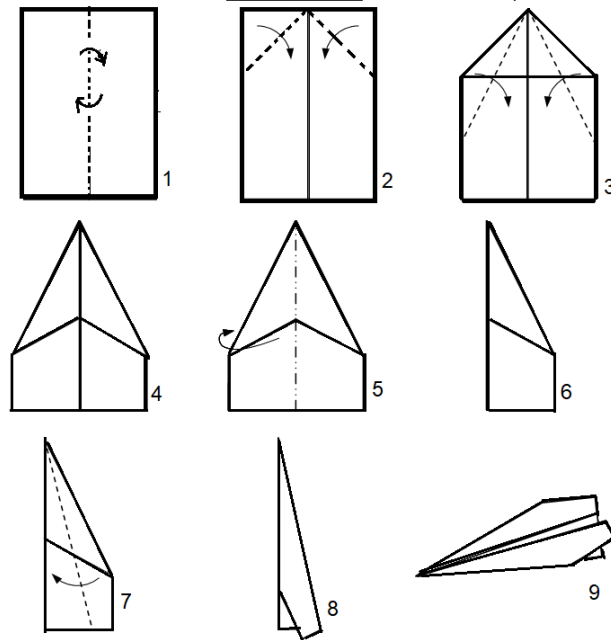
- We will explore the concept of gravity.
- We will begin by exploring the speed and force of a gravitational pull by dropping objects of different mass and seeing which ones fall faster and slower. You can use any household objects that are unbreakable and time the fall. Start with making a guess of the objects that will fall fastest and then test these out.

Object	Guess / Hypothesis	Result / Experiment Evidence
Ball		
Paper		
Pen		

You will discover that the more massive an object is, the stronger its gravitational pull is.

**15 minutes**

- You will now make your own paper planes. Explore and try out two or three different designs for your planes (you can use heavier or lighter types of papers). Here's one example of a plane that you can build by following the steps below:



**15 minutes**

- For each design, you will:
  - Try and fly your plane.
  - Try different ways to throw the plane and see if it flies higher and / or further
  - Think about why some planes can go going higher / further than others
  - Try to add wind with a real fan or paper fan to see if the plane flies further.

Reflect on what you learned from the experiment:

- What did they notice?
- What are they wondering about real planes based on what they observed with the paper planes?
- Which was the most successful plane? (e.g. the one that reached the furthest, or the highest, or the one that stayed in the air for longer)?
- What were the characteristics of the most "successful" plane?

Any object that is left in mid-air will fall to the ground because of a force of the earth called gravity. Gravity is a force that tries to pull two objects toward each other. Anything which has mass also has a gravitational pull. Earth's gravity is what keeps you on the ground and what causes objects to fall.

Write a story titled "A world without gravity!" Let your imagination run free - thinking about a world where nothing stays down. You and everything around you could float and fly!

## DAY 2

Today you will explore water vehicles and what causes them to float.

### Suggested Duration

### Activity and Description

#### 5 minutes

- Go back to the first list of vehicles that they created on Day 1.
- Add to it additional water vehicles that you know.
- Think about the different types of water bodies like lakes, rivers and seas, their characteristics (e.g. rivers flow in one direction, oceans have waves, water in ponds doesn't run, etc.), and the different reasons people would be on water vehicles.

#### 10 minutes

- Write or draw the different reasons why people would use water vehicles.
- For example: fishing, transportation, pearl diving.

#### 20 minutes

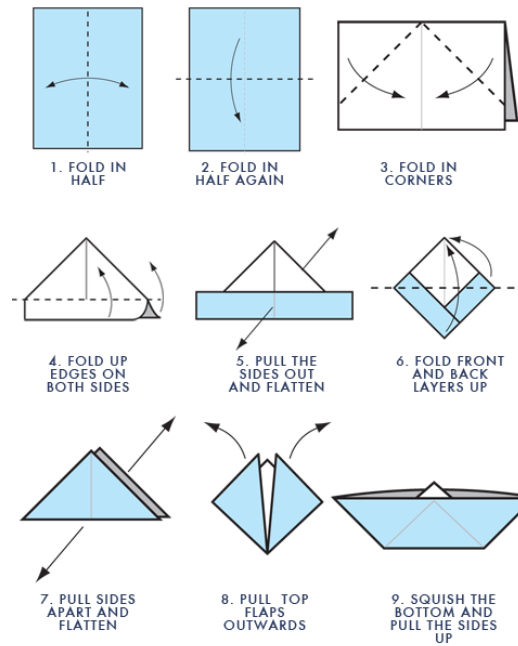
- Explore what sinking and floating is.
- Fill a tub with water and collect a few "waterproof" objects that do not have batteries.
- Make a list of these objects and try to guess whether the objects will sink or float in the water. Then place the object in the tub and write what happens.

For example:

Object	Guess / Hypothesis	Result / Experiment Evidence
1.Spoon	Sink	Float
2.Bowl	Sink	Sink

3.Block	Float	Sink
4.Pen Cover	Sink	Float

<b>10 minutes</b>	<ul style="list-style-type: none"> <li>• Think about the reasons why some objects sink or float</li> <li>• For example: <ul style="list-style-type: none"> <li>• Objects that are heavy sink.</li> <li>• Objects that are big sink.</li> </ul> </li> </ul>
<b>5 minutes</b>	<ul style="list-style-type: none"> <li>• We will now explore the idea that neither size nor weight determines whether a body floats or sinks.</li> <li>• Put an orange in a glass or tub of water and you will see that it floats. Now peel the same orange and put it in the same glass or tub water and you will see that it sinks. This is even though the orange is the same size and weight, because there is air between the orange peel and the orange reducing its density so it floats! The orange without the peel has more density than the water, so it sinks!</li> </ul>
<b>10 minutes</b>	<ul style="list-style-type: none"> <li>• Re-try the experiment to test your reasons or hypothesis and make a new guess on how boats can float. Based on the experiment, write or share aloud the characteristics of objects that float.</li> <li>• Sinking or floating has to do with a concept called density. Density is a measure of how compact the mass in a substance or object is or how densely things are packed. Any object with a density higher than the density of water will sink and anything with density less than that of water will float</li> <li>• Calculate the percentage of times that your hypothesis was right. Hint: (Total number of right answers divided by the total number of objects) multiplied by 100</li> </ul>
<b>20 minutes</b>	<ul style="list-style-type: none"> <li>• Make your own paper boats that float on the water. You are encouraged to come up with your own designs. Here is an example:</li> </ul>



- Make multiple boats (of different sizes and made from different types of paper) and check if they sink or float.
- Try to move your boat.
- Blow on your boats with a straw and see how it pushes the boat forward. This is how sailboats move with the wind.

### 10 minutes

- Create your own rowing oars to explore how engine propellers help push the water and move the boat forward.
- Make the oars with little toothpicks, popsicle sticks or straws etc.
- Make sure the bottom of the oar has a broad and flat surface. The action of the oars pushing the water back helps the boats move forward.





## DAY 3

Today you will explore land vehicles and what causes them to slow down.

### Suggested Duration

### Activity and Description

**15 minutes**

- Refer again to the original list and add land vehicles that you can think about. Think and try organizing these in terms of speed from the fastest to the slowest land transportation for example:
  - Train
  - Motorbike
  - Car
  - Bus
  - Bicycle

**15 minutes**

- Explore the concept of friction and the importance of wheels to help most land motion.
- Friction is the resistance of motion when one object rubs against another. Anytime two objects rub against each other, they cause friction.
- Friction works against the motion and acts in the opposite direction – it is what causes objects to slow down unless pushed.
- Any object that rubs against another object or even against air in the case of air resistance causes friction
- For example, even if you rub your hands together that causes friction.
- Move different objects on the ground to see the effect of friction.
- Move a square or rectangular block or a triangular shaped object – these can be constantly pushed with force, but these cannot be rolled. Try the same with a circular tube to see how it rolls forward more easily with less force

**20 minutes**

- Is it easier for the vehicle to move faster when the ground is bumpy or uneven?
- Guess and test whether they think a tube or toy car can move faster on different surfaces and roads.
- The surfaces on which the vehicle moves faster with less force has lower friction
- Apply the same level of force or push on the vehicles.

Surface	Guess / Hypothesis	Result / Experiment Evidence
Smooth wooden or tile floor	Fast – Low Resistance (Friction)	Fast – Low Resistance (Friction)
Sweater on a surface (bumpy or uneven surface)	Medium – Med Resistance (Friction)	Slow – High Resistance (Friction)
Cement floor	Fast – Low Resistance (Friction)	Medium – Resistance (Friction)
Carpet		
Grass		

**Numeracy extension:** Make a bar chart depicting the number of times your hypothesis was right and the number of times it was wrong.

Explore why you think some surfaces increase or decrease the friction and write the reasons.

**15 minutes**


- Explore why they think some surfaces increase or decrease resistance and share answers with parents.
- Design a ramp that can be made with a book on any flat surface that is at an incline.
  - How much effort / force needs to be applied to help a tube, or a toy car go down?



- How much effort / force needs to be applied to help a tube, or a toy car go up?

## DAY 4

Today you will learn about the rules and regulations for transportation.

Suggested Duration	Activity and Description
20 minutes	<ul style="list-style-type: none"> <li>• Now that we have learned how to design vehicles that can go really fast, it might also be dangerous to move them so fast. So, let us understand the rules that help us manage the speed. Did you know that one person gets hurt every 25 seconds because of a road accident resulting from very high speeds?</li> <li>• Think of all the rules and regulations associated with transportation and also the professions.</li> </ul> <p>Land vehicles:</p> <ul style="list-style-type: none"> <li>• Explore all traffic rules and as a traffic police they will make 5 relevant signs and lights that help slow down land transportation to prevent accidents. Design your own signs that you think will be more effective in preventing accidents. For example:               <ul style="list-style-type: none"> <li>○ Red, yellow and green light,</li> <li>○ Stop sign</li> <li>○ School zone sign</li> <li>○ Zebra crossing</li> <li>○ Speed limit sign</li> </ul> </li> </ul>
20 minutes	<ul style="list-style-type: none"> <li>• Think about traffic in the water and people that will help in managing this.</li> <li>• Make your own lighthouse to help boats navigate in the darkness</li> <li>• Make this with empty toilet paper rolls, tubes and paper.</li> </ul> 
20 minutes	<ul style="list-style-type: none"> <li>• Pretend to be the air-traffic controller and help planes with when to take-off, land or where to fly to make sure that planes do not crash into each other.</li> </ul>

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- Think of the shortest message you can send to pilots to make sure there are no issues.
  - Literacy extension: We will learn how to summarize key messages. In the case of air control and other things like SMS etc. We have to pass on important information, and we cannot use too many words to share this information. How can we best summarize the message to pass the key important points?
  - (2 levels of worksheet are attached)
  - Write your own short messages to communicate the following scenarios. Communicate 1 or all 3 of the scenarios:
    - Booking a railway ticket on the phone (Key points: i) Origin and Destination - From where to where are they travelling; ii) Date and timing; iii) Name of the train; iv) Class of travel; v) Number of passengers)
    - A captain on a ship letting the ship crew know about a storm (Key points: i) Details on the storm – intensity of the storm; ii) What should the crew be doing; iii) What safety precautions can we take etc.)
    - An announcement from the pilot in the plane (Key points: i) Destination – where are they travelling; ii) Travel – how long is the flight and what will the weather be; iii) Safety procedures - seatbelt, walking in the plane etc.)
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## DAY 5

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Today you will imagine and create their own vehicle that combines all the science principles that they have learnt.

### Suggested Duration

**20 minutes**

### Activity and Description

- Imagine and create your own vehicle that combines all the science principles you have learnt until now:
    - Anti-gravity
    - Floating
    - Low resistance
  - Describe the features of this vehicle through drawings or writing.
    - How can we make sure that the vehicles stay in the air and not fall with gravity?
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	<ul style="list-style-type: none"> <li>• What will make the vehicle stay afloat in the water?</li> <li>• How can the vehicle face the least friction to move forward with the most speed and the least amount of effort?</li> </ul>
<b>10 minutes</b>	<ul style="list-style-type: none"> <li>• Think of the purpose of the vehicle.</li> <li>• For example: <ul style="list-style-type: none"> <li>• To pick up sick people to go to the hospital</li> <li>• Pick up children to go to school</li> </ul> </li> </ul>
<b>20 minutes</b>	<ul style="list-style-type: none"> <li>• Draw your vehicle and label it and show it your family.</li> <li>• Explain the relevant features to make it work best on land, water and air to them.</li> </ul>

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Family feedback should include:

- What do they love about the vehicle's design?
- Any questions they might have about the explanation?
- Any areas of improvement in either the design or the explanations?

Use the feedback to revise your designs.

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## ASSESSMENT CRITERIA

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- Creativity in the final vehicle designed, including the purpose
- Demonstration of understanding of physics concepts of gravity, density, force, motion, friction, floatation and sinking
- Ability to design a plane that flies, the fastest land transportation and a boat that floats
- Clarity of road signs, lighthouse and ATC
- Learners hypothesis and guesses with reasons explaining the project phenomena

## ADDITIONAL ENRICHMENT ACTIVITIES

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Learners can explore creating their own moving car with rubber-bands as in Level 3 of the same project.

## MODIFICATIONS TO SIMPLIFY

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Learners can test the concepts of friction and sinking and floating by designing their own boat and testing the cars and then design their own vehicle.



## WORKSHEET 1

**Can you summarize the following instructions between a pilot and air traffic controller?**

*Example:*

**Long Form:** Hello, I am testing the sound system. Pilot Sam, can you hear me?

**Short Form / Summary:** Mic, check testing.

Question 1:

**Long Form:** Hello, how are you? I am trying to test this mic, this is Pilot Sam. I can hear you, can you hear me also?

**Key Messages:**

**Short Form / Summary:**

Question 2:

**Long Form:** Hello Pilot, can you hear me? Please do not come to land right now because there is another flight using the runway to take off. Please circle around the airport in the air for some time

**Key Messages:**

**Short Form / Summary:**

Question 3:

**Long Form:** Air Controller, this is Pilot Sam from the Plane that was coming from London. We have

flown a long time and our fuel is finishing, if this happens, we will not be able to continue flying and might even crash. Please can we land soon

**Key Messages:**

**Short Form / Summary:**

Question 4:

**Long Form:** Ok Pilot I understood. I have some important questions how much more petrol do you have in your plane? How much more time can you fly before you have to land? I have 2 more flights; I can stop them and ask you to land first.

**Key Messages:**

**Short Form / Summary:**

**Can you summarize the following communication between the pilot and the air control tower?**

Question 5:

**Long Form:** Thank you, Air Controller – Since we flew for 10 hours, we only have 5 litres of fuel left and maybe we can circle one more time for another 3 minutes and then we will have to land. I suggest you ask the other planes to wait

**Key Messages:**

**Short Form / Summary:**

## WORKSHEET 2

**Directions:** Read each passage

1. Create a title for the passage related to the main idea.
2. Accurately summarize the text.
3. Your summary must describe all key ideas from the text.
4. Do **not** include opinions or personal info in your summary.
5. Highlight or underline key ideas in the passage

**Example:**

**Long Form:** *There was a grumble in the air and dark clouds forming, the captain on the ship looked up at the sky. The captain had his hands folded and was wearing a rather worried expression while he muttered to himself. The mild breeze that was blowing against the sail through the afternoon, was now a strong gusty wind and the entire ship was rocking from side to side. The sea waves were beginning to rise and crash into the ship, sometimes coming over the deck*

**Main Idea:** *There was a storm and the captain was worried*

**Short Form:** *There was a storm forming and the captain of the ship was worried. The wind was stronger than the afternoon, rocking the boat and the sea waves were coming over the deck.*

**Paragraph 1:** Imagine a herd of elephants almost flying past you at sixty miles per hour, followed by a streak of tigers, a pride of lions, and a bunch of clowns. What do you see? It must be a circus train! As early as 1871, people started using trains to have a moving circus from city to city. Before circus trains, it would be difficult for people to move the animals, performers, and equipment with a team of more than 600 horses. Since there were no highways, these journeys were tough and took a long time. Circuses would stop at many small towns between the large venues. Performing at many of these small towns did not make a lot of sense or make money for the circus. It was difficult for the circus to become too big because of these issues until they started using trains and reaching many of the big cities for big audiences. These performances were much more profitable, and the profits went toward creating an even bigger and better circus. Multiple rings were added, and the show went on. Today, Ringling Bros. and Barnum and Bailey Circus still rely on the circus train to transport their astounding show

**Main Idea of the Passage:**

**Summary:**

**Paragraph 2:** I am trying to test the sound system and checking that you are able to hear and understand me clearly. I am speaking from the main air controller tower in the Dhaka airport and my name is Ron. My job is to make sure that only one plane at a time is taking off from the runway at a time to make sure that planes do not crash. Since you cannot see the other planes that might be ready to take off or land, I will coordinate between all of us. There are many planes waiting to take off and since there is only one runway to be used, we think it is better for you to not land right now. I understand that you have come from far away, so I want to make sure that you have enough fuel in the tanker to be able to stay in the air for some time. We want to make sure that another three flights take off before so that the passengers on the flight do not get very late to their destination.

**Main Idea of the Passage:**

**Summary:**