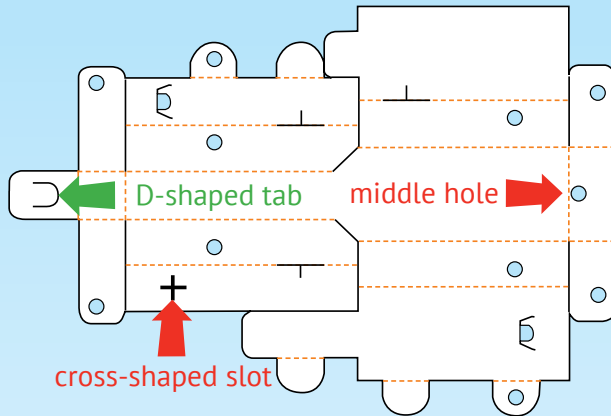


# PUPIL WORKSHEETS

### BUILD THE CAR CHASSIS

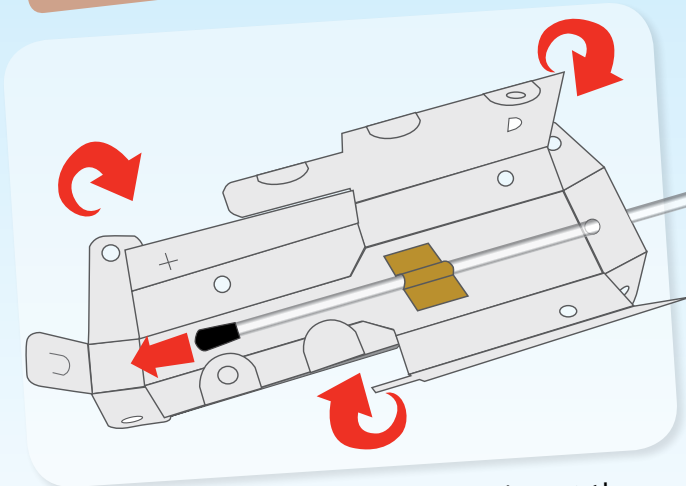
**You will need:**

- 1 x Chassis Net
- 1 x Hard Acrylic Tube
- 1 x End Cap
- 1 x Tether Line Guide (soft tube)
- 2 x Axles
- 1 x Axle Guide (small soft tube)
- 4 x Wheels
- 4 x Axle Bushes
- Scissors, Ruler

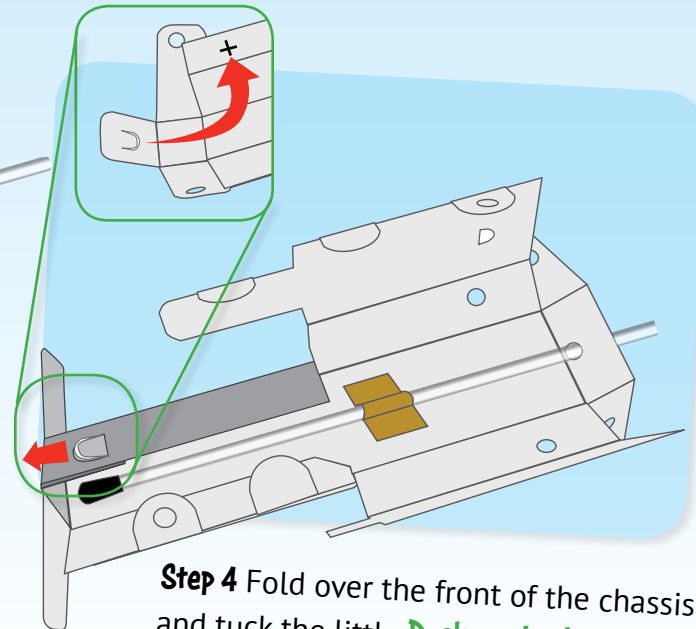


**Step 1** Remove the chassis net from the surround and push out all the pre-cut holes.

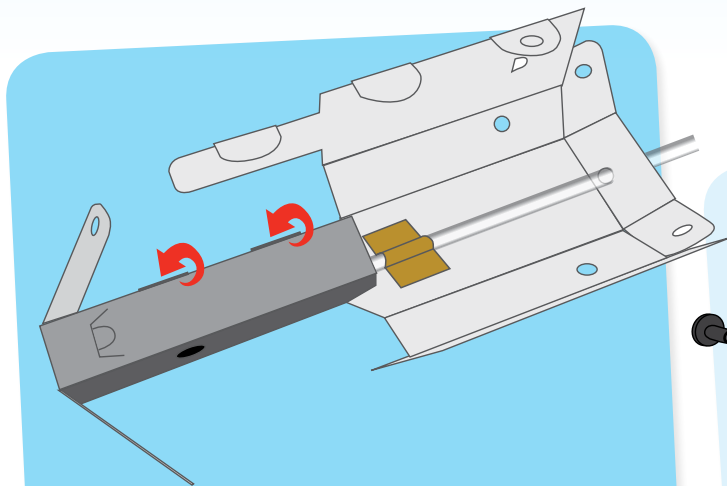
**Step 2** Take the hard acrylic tube and end cap from your consumables pack. Push the end cap onto the tube and secure using sticky tape.



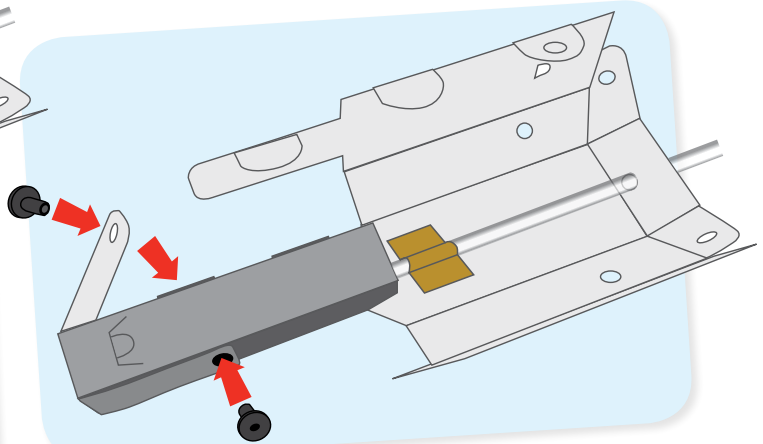
**Step 3** Fold all the score lines and insert the hard acrylic tube with the end cap through the **middle hole**. Secure with sticky tape.



**Step 4** Fold over the front of the chassis and tuck the little **D-shaped tab** through the **cross-shaped slot** in the chassis.

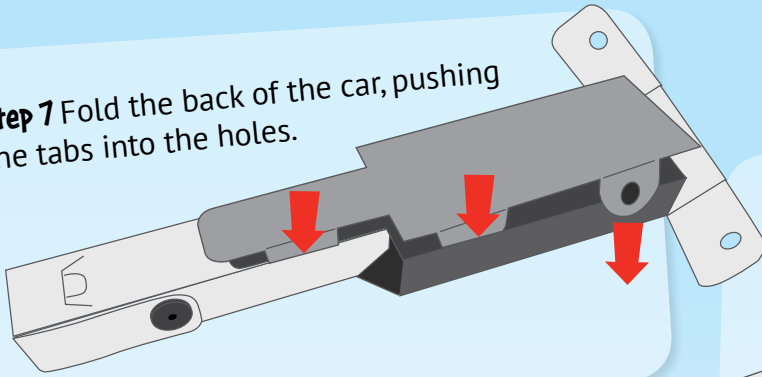


**Step 5** All solid tabs fit into pre-cut slots. All tabs with holes in should be on the outside of the car.

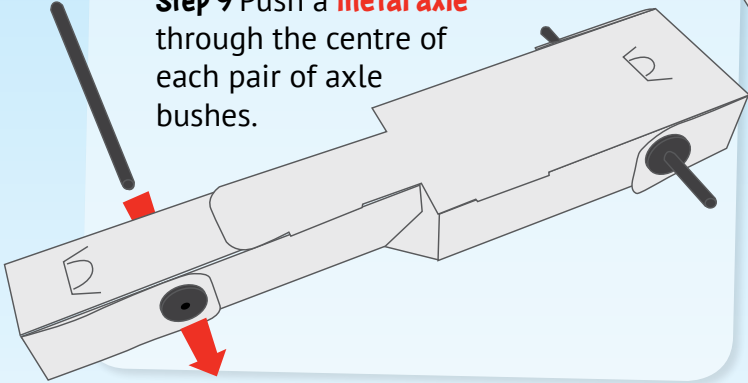


**Step 6** Line up the holes on the tabs and hold them together by pushing the **axle bushes** into place.

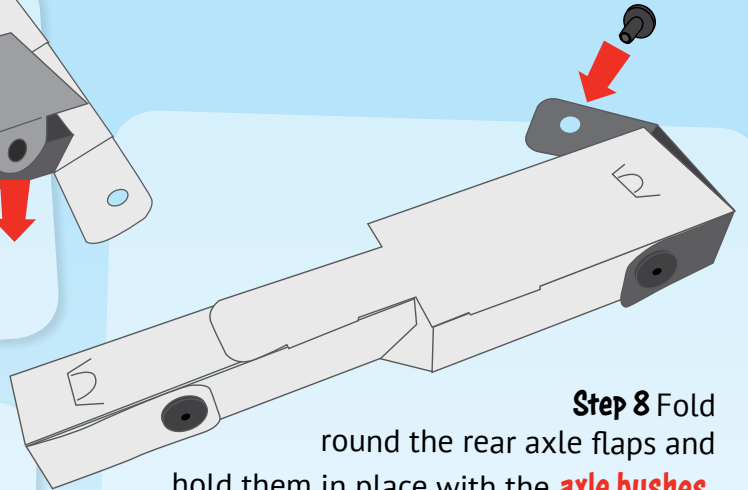
**Step 7** Fold the back of the car, pushing the tabs into the holes.



**Step 9** Push a **metal axle** through the centre of each pair of axle bushes.

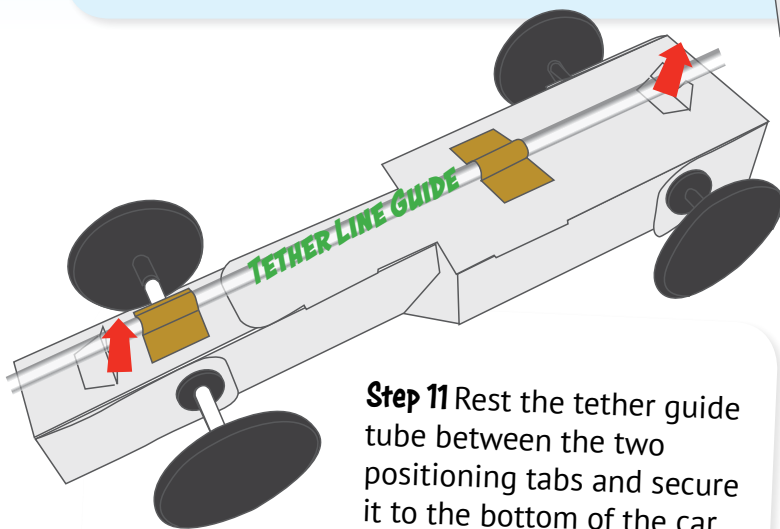
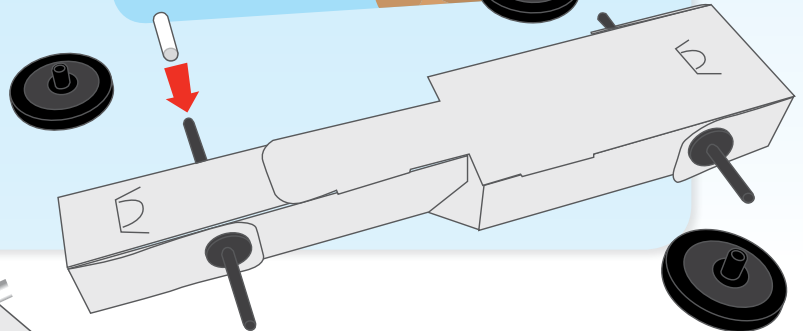
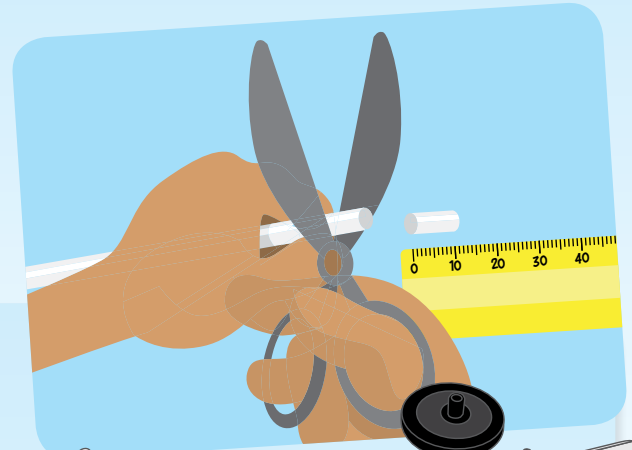


**Step 8** Fold round the rear axle flaps and hold them in place with the **axle bushes**, just like at the front of the car.



**Step 10** Using a ruler carefully measure and then cut 2 x 10mm pieces of the small plastic tube. These will be used as **axle guides**.

Add one of these axle guides to each side of the front axle only, then push the wheels onto the axles firmly.



**Step 11** Rest the tether guide tube between the two positioning tabs and secure it to the bottom of the car with sticky tape.



**Step 12** Turn your car over and now you're ready to add a bodyshell.

# FRICTION

Friction is a force acting between two surfaces that are moving against each other.

When you try to push a heavy box across the floor, friction makes it difficult.

Friction between your shoes and the playground stops you slipping.

- What might reduce the friction between your shoes and the playground?
- How could you increase the friction between your shoes and the playground?

## CLASSROOM ACTIVITY

You will need:

A flat board or strong piece of cardboard

A pile of thick books

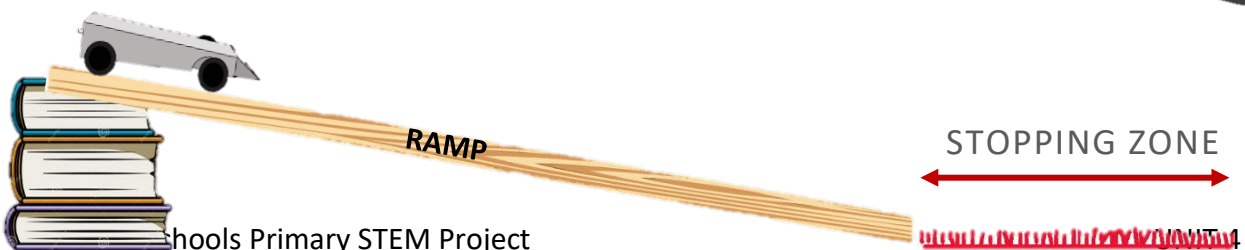
Tape measure or ruler

Assembled Primary STEM Chassis

Various textured materials: carpet, felt, corrugated cardboard etc.

Create a ramp using the pile of books and the board or cardboard.  
Put the Primary STEM Chassis at the top of the ramp and let it go.  
Measure how far chassis travels past the end of the ramp.  
At the bottom of the ramp experiment using different textures to create a stopping zone.

Which material stops the car the quickest?  
What forces are acting on the chassis  
What effect does each force have on the chassis?





## EXPERIMENT WITH FRICTION

Team Name.....

Use the table to record your results in the first column to record the material in the stopping zone and the second column to record the distance your chassis travels past the end of the ramp.

<b>MATERIAL</b>	<b>DISTANCE in cm</b>



## EXPERIMENT WITH FRICTION

Team Name.....

Use the table to record your results in the first column to record the material in the stopping zone and the second column to record the distance your chassis travels past the end of the ramp.

<b>MATERIAL</b>	<b>DISTANCE in cm</b>



# INVESTIGATING TEXTURES

Look closely at the materials that you are using.

Draw a **side profile** of its texture

Write three words to describe the texture of the material

<b>Material</b>	<b>Draw a side profile of the material showing surface texture.</b>
Name of Material	
3 words to describe the material	



# WRITING UP EXPERIMENTS



When you carry out an experiment, you will need to write up what you did.

You will need to explain how you did it and what you learned. Here is an example of how you could set out this information.

Start with a title. This could be something like

**Experiment to test.....**

**Experiment to investigate.....**

**Experiment to look at.....**

Underneath the title you should use the following headings

**Aim :** This explains what your experiment is trying to investigate.



**Method:** This explains what you did and should include:



- a list of the equipment that you used
- a diagram of how the experiment was set up
- step by step instructions what you did



**Results:** This may be a table of results, or you could write a few sentences to say what the results were.



**Conclusion:** The conclusion is to explain what your results tell you about what you were investigating.










**Evaluation:** The evaluation is to say how the experiment went and if there were any improvements that you could make if you were to do the experiment again.





# EXPERIMENT TO.....

 <b>Aim</b> What are you testing?	
 <b>Equipment</b> What did you use?	 <b>Method</b> What you did.
<b>Diagram</b> How did you set up the equipment?	
 <b>Results</b> What happened?	 <b>Conclusion</b> What did you find out?
 <b>Evaluation</b> How did the experiment go?	





## DESIGN A BODY SHELL

Using what you have learned about the forces that affect a moving vehicle design a body shell to cover your chassis.

Your bodyshell must:

- Help make the chassis more aerodynamic
- Make the chassis look attractive
- Use your team colours
- Include your team logo



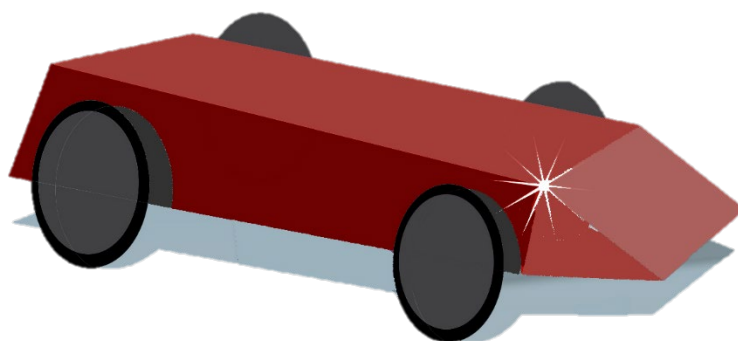
**Each member of the team creates one idea and then, as a team, look at all the suggested bodyshell designs.**

The Design Engineer and Manufacturing Engineer should decide which would be the best design and how would be best to make it.

The bodyshell could be made by adding shapes to the chassis using card and either glue or tape or you could construct a bodyshell net.

The Graphic Designer is responsible for choosing the colour scheme of the car and its overall look.

**The Graphic Designer should draw the final design.**

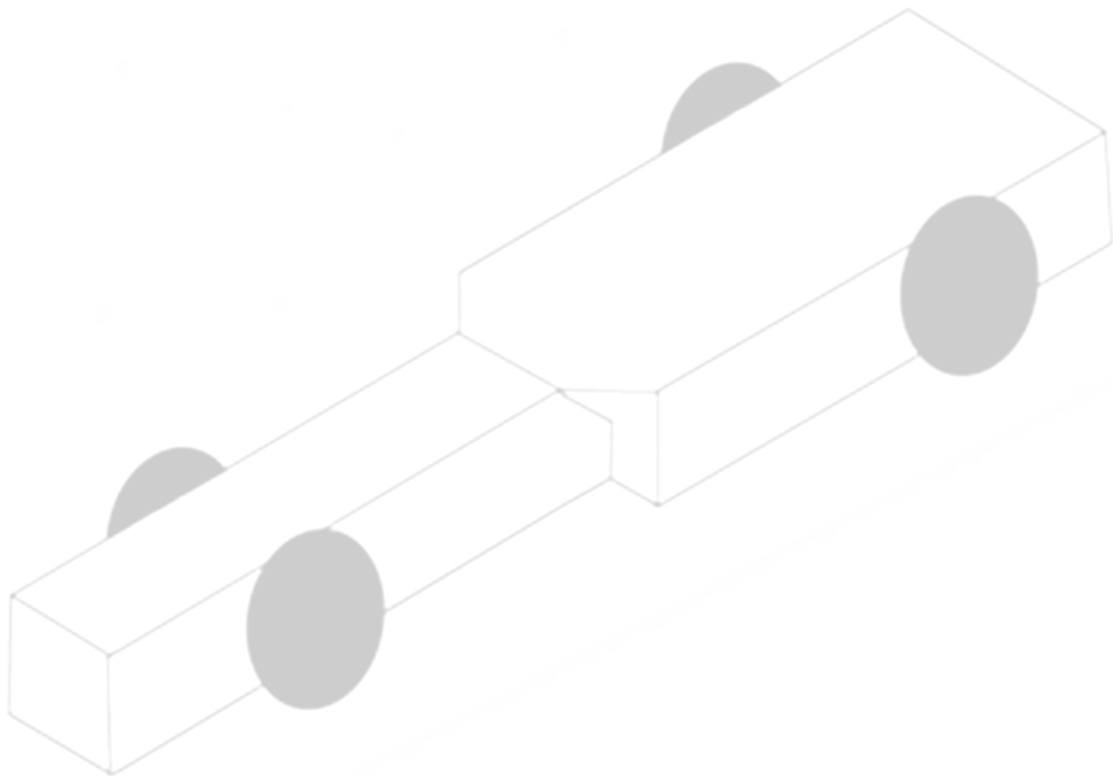
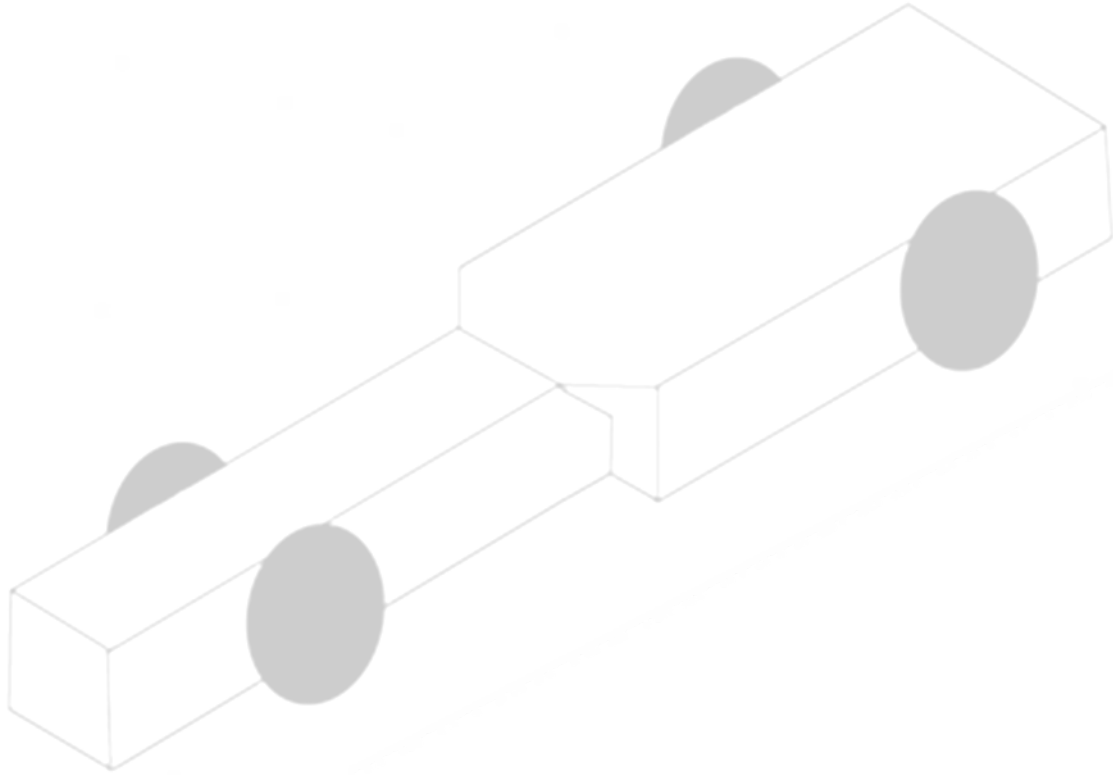


**Remember:**

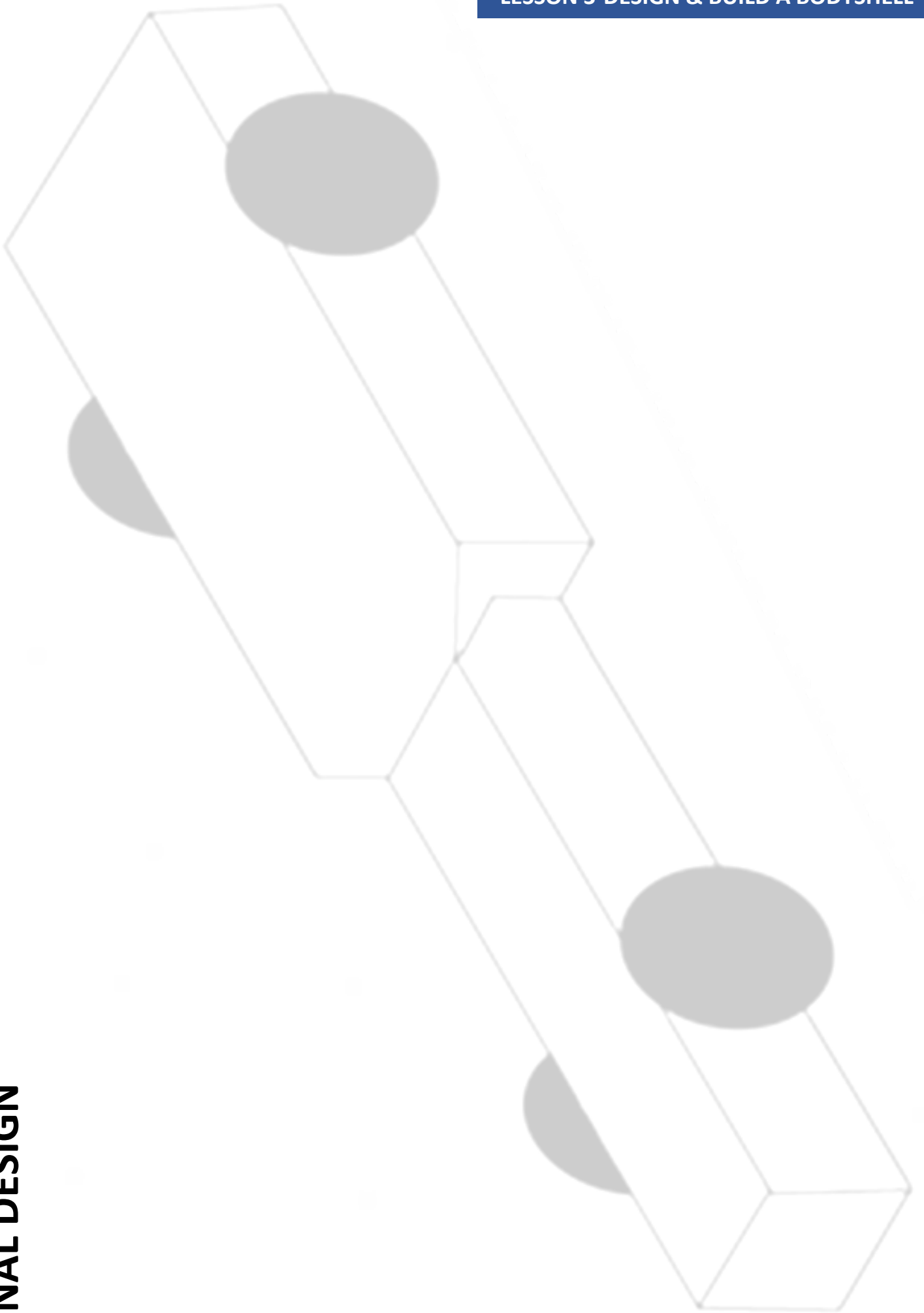
- The **livery** of the car must fit with the team identity.
- Consider weight. Don't make the bodyshell too heavy, or it will slow down your car.



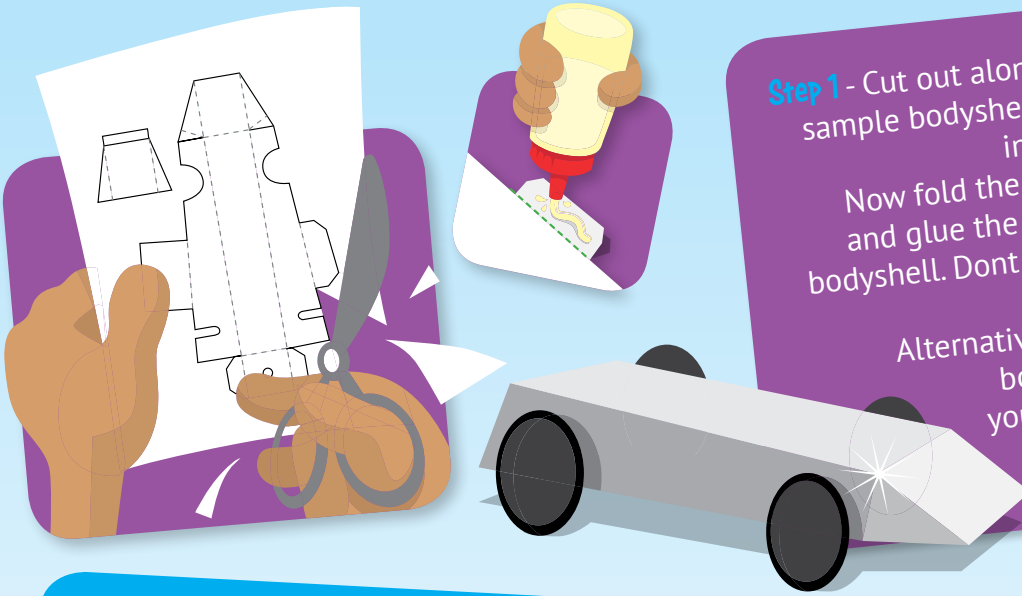
Using the templates below as a guide, design 2 different aerodynamic body shells.



**FINAL DESIGN**



# BUILD A CAR BODYSHELL



**Step 1** - Cut out along the solid black lines of the sample bodyshell template provided and fold inwards along the dotted lines. Now fold the template around your chassis and glue the tabs in place to form a simple bodyshell. Don't forget to add the underside of the nose cone. Alternatively, you could design your own bodyshell by carefully measuring your chassis and creating a net on squared paper.

**Step 2** - You can decorate this template or use it to help you make a template of your own.

You can use any method you like to make your bodyshell look more attractive. If you want to use a computer drawing programme, your teacher can give you a template to work on.

Use your knowledge of **aerodynamics** and **air resistance** to design a car shape which will make your chassis more streamlined.

If you want to decorate your bodyshell, it is best to do this before you cut it out.



**Step 3** - Your car is now ready to race. Have a look at **LET'S RACE! INSTRUCTION SHEET NO.3**

Watch the finish line carefully to see which car crosses first

**How well did your car perform?**

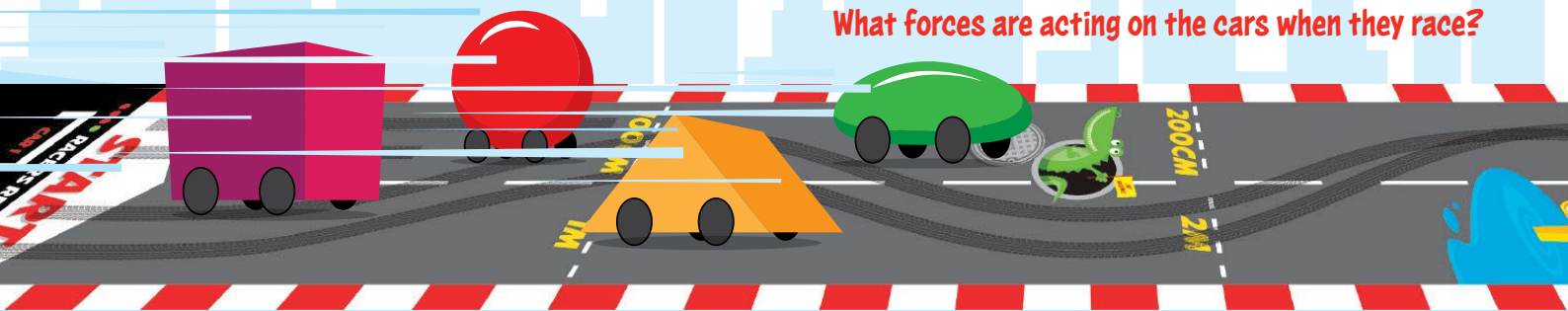
**Step 4** - Now that you've raced your car, you might want to think about how to make improvements to the design of the bodyshell to make your car faster?

You will need to consider the shape and weight of the car and how these can affect its speed.

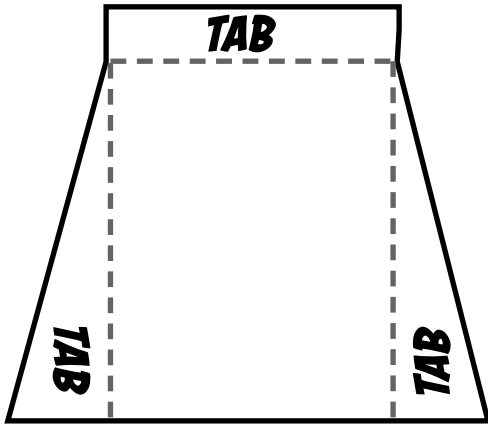
**Things to think about...**

**Which car is the fastest? Why do you think that it was the fastest?**

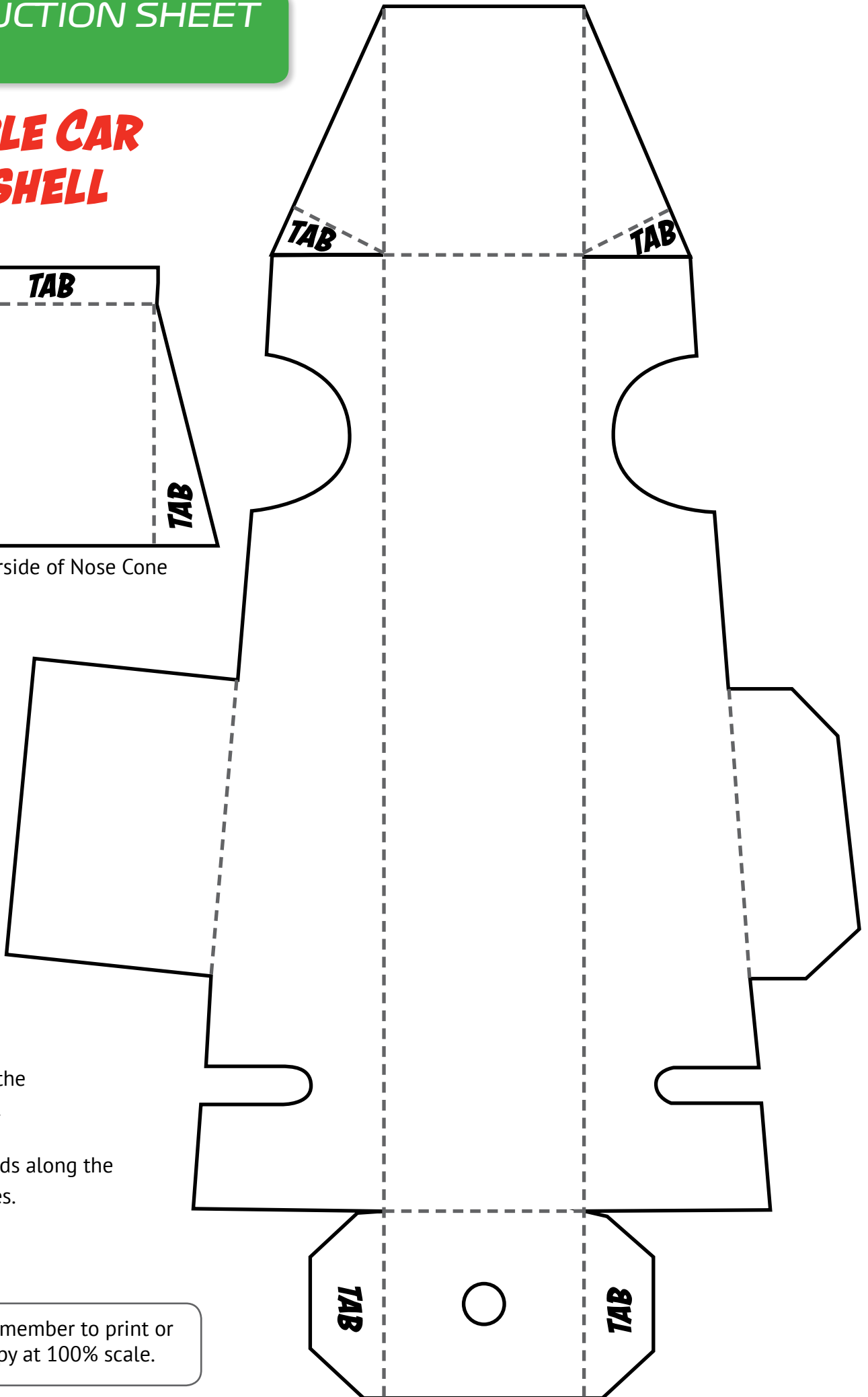
**What forces are acting on the cars when they race?**



# SAMPLE CAR BODYSHELL



Underside of Nose Cone



Cut along the  
**Black** lines.

Fold inwards along the  
**Dotted** lines.

Note: Remember to print or  
photocopy at 100% scale.



# SUMMARY & EVALUATION.

Have you completed the following tasks?

How well have you done?

Have you.....	y/n	How well did you perform this task?
Assembled a car chassis?		★ ★ ★ ★ ★
Designed a car bodyshell?		★ ★ ★ ★ ★
Drawn a 3D rendering of your bodyshell?		★ ★ ★ ★ ★
Add other things that you have done here.		★ ★ ★ ★ ★
Add other things that you have done here.		★ ★ ★ ★ ★
Add other things that you have done here.		★ ★ ★ ★ ★
Add other things that you have done here.		★ ★ ★ ★ ★

In this box write down one thing that you think you did well and one way that you could make improvements.

.....

.....

.....

.....

.....

.....

.....

.....





## ABOUT FORCES

Below you will find 5 different forces, 5 definitions and 5 examples.

Can you match the force to the correct definition and example?



GRAVITY

AIR RESISTANCE

THRUST

ROLLING RESISTANCE

FRICTION



The force of attracts objects towards each other

The force between two surfaces that are sliding across each other

The force between a rolling object and the surface that it is rolling on

The force that slows down an object moving through the air

To push with force



A person using a parachute to slow the fall after jumping out of a plane

A rocket fired into space.

Tyres on the road surface.

Rubbing hands together

A ball dropping towards earth

Complete the table below

FORCE	DEFINITION	EXAMPLE



Complete the table below

FORCE	DEFINITION	EXAMPLE

