This pack includes ideas to engage and excite your pupils about **maths, science, design and technology**, and **art** and **design** before your visit to **The MAD Museum** to see the amazing world of automata and marble runs! It also features printable activities to help bring these subjects to life in your classroom.

BEFORE YOUR VISIT

Watch this fantastic educational video from the James Dyson Foundation, which explains forces and follows engineers as they create several different marble runs. Each one uses different materials and angles to **demonstrate how gravity and friction affect the speed of the marble:** https://www.youtube.com/watch?v=IN0Wn0XgPXQ

Why are marbles sphere-shaped? Take our **3D Shape Challenge** to find out and ask your pupils to compile their findings in simple bar charts. To set up the challenge, lean a sheet of cardboard (or other flat, smooth material) against a chair seat or low surface. Place one 3D object at a time at the top of the slope. Some won't roll down at all. What happens if you balance them on an edge before letting go? If you have a cylinder, what happens if you balance it on a flat circular end? Which shape consistently rolls down the fastest? Time how long they take to get to the bottom and fill in your bar chart.

You could use the same bar chart sheet to carry out a **Fun Friction Challenge**. Using a variety of materials, such as sandpaper, fun fur, Astroturf, foil or plastic, cover several small cardboard slopes. Roll a marble (or a toy car) down each slope and time how long it takes to get to the bottom. Which material created the most friction and made the marble roll slowest?

BEFORE YOUR VISIT CONTINUED...

- Demonstrate **what gears do and how they work** when two or more gears are together. Watch this BBC Bitesize clip to show your pupils how bike gears are used to move faster and slower and watch some children complete a fun uphill challenge: https://www.bbc.co.uk/education/clips/zpvyk7h

- Also see this simple gear explanation on DK Find Out: https://www.dkfindout.com/uk/science/simple-machines/gears/

- Ask your pupils to **think of moving toys they might own or have seen in toyshops**. What were they? Can you write a list? It might include toy cars, train sets, a jack in the box, a clockwork wind-up robot, and toys you can push and pull along. Discuss how they work and the simple mechanisms they might use.

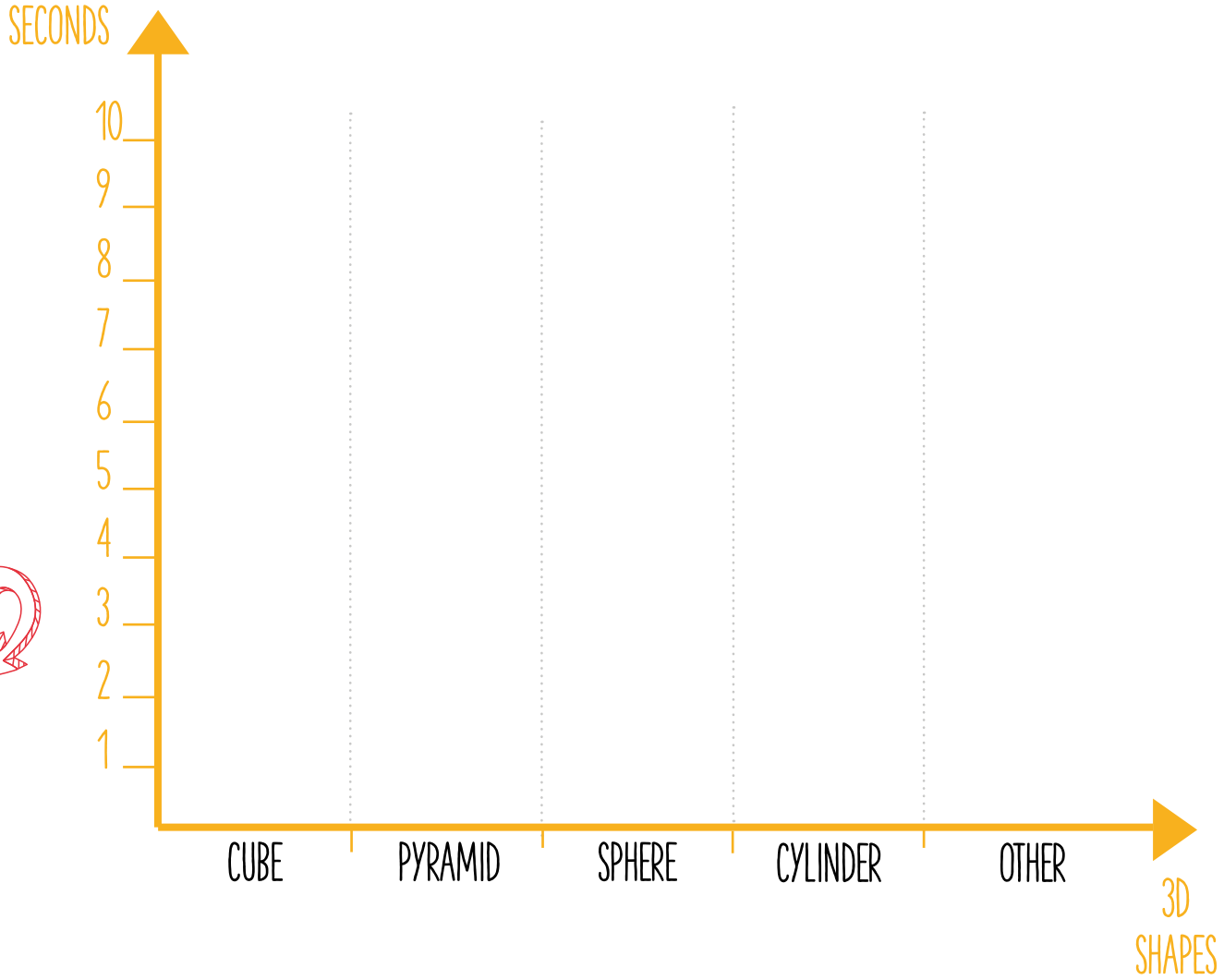
- Show an example of a toy that uses a cam – there are many pictures on Google and in The MAD Museum. Now ask everyone to design their own automata (moving toys) **using cams** on our **Make a Moving Toy** sheet. For now, do the design only. Come back to it after you have visited The MAD Museum.

- To get everyone excited about your visit to The MAD Museum, show them this video by the band OK Go, which features amazing mechanical art and design: https://www.youtube.com/watch?v=qybUFnY7Y8w

3D SHAPE CHALLENGE

Which 3D shape reaches the bottom of a ramp first? Use your results to complete this bar chart.

Before you do this experiment, which 3D shape do you predict will be the fastest. Why? WRITE IT HERE. Check later to see if your prediction was correct.



TEACHERS! See our accompanying **Teacher's Resource Pack** for guidance on how to set this up and how to adapt it for a Fun Friction Challenge too.

DESIGN A MOVING TOY

Design an automaton (moving toy) that uses cams. Draw it here and label the parts that move.

WHAT MATERIALS WILL YOU USE?

_____

_____

_____

WHAT TOOLS DO YOU NEED?

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CHOOSE ONE OF THESE THEMES FOR YOUR TOY: GARDEN PLANTS, ANIMALS OR THE PLANETS.