THE SCIENCE OF ROLLERCOASTERS

LESSON CONTENT: PRE TRIP LESSON

This lesson is designed to be delivered prior your school visit to THORPE PARK Resort

KEY STAGE 4

RESOURCES:

Student Worksheet 1 (one per student)
Student Worksheet 2 (one per student)
The Science of Rollercoasters presentation (pre-visit slides)

KEY WORDS: Speed, distance, time, balanced forces, unbalanced forces, energy, motion

STUDENTS WILL LEARN ABOUT:

- Calculations involving speed, distance and time
- Different units for speed, distance and time
- Distance time graphs
- Balanced and unbalanced forces
- Energy transfers

LESSON PLAN

STARTER

- Discuss how this lesson will complement their visit to THORPE PARK Resort and will help them understand some of the key principles using the white knuckle rides they will see and experience at THORPE PARK Resort
- Distribute Student Worksheet 1 and let students work their way through the questions
- Once you are satisfied that they have completed this exercise, display the answers on slide 2 and work through these as a class

MAIN

- Copy and distribute Worksheet 2 to every student
- Let students complete the questions on their worksheets. Questions have been replicated on slides 4-22 for you to display if students are struggling and require a detailed explanation. Ride data has also been included throughout the slides for students to refer to
- Before students tackle question 6, you can display the Tidal Wave example on slides 13-14
- Once they have finished, display the answers on slides 23-27 and work through these as a class

SOME POTENTIAL AREAS TO COVER ARE:

- Take care with rolling objects on the floor
- Check if any students have irritant issues with handling foam pipe
- Give students an appropriate sized workspace
- Take care with cutting any materials

PLENARY

Q+A to clarify and preparation for the THORPE PARK Resort trip.

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WORKSHEET 1

IN THIS LESSON YOU ARE GOING TO LEARN ABOUT

- Calculations involving speed, distance and time
- Different units for speed, distance and time
- Distance time graphs
- Balanced and unbalanced forces
- Energy transfers

Name: ..... Class: ..... Date: .....

STARTER ACTIVITY

Complete the following:

1. Speed = ... ÷ .....

2. The standard unit for speed in science is metres per second, or m/s.
List any other units you can think of for speed.

.....

.....

3. What is the speed of a rollercoaster carriage on a track moving 200 m in 20 s?

.....

.....

4. Kinetic energy is a form or type of energy.
Name as many other forms or types of energy as you can.

.....

.....

5. Name the force that opposes motion.

.....

.....

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WORKSHEET 2

IN THIS LESSON YOU ARE GOING TO LEARN ABOUT

- Calculations involving speed, distance and time
- Different units for speed, distance and time
- Distance time graphs
- Balanced and unbalanced forces

Name: ..... Class: ..... Date: .....

COMPLETE THE FOLLOWING QUESTIONS:

1. SAW - The Ride is an extreme rollercoaster experience. Work out the speed of a carriage travelling on SAW - The Ride for 200 m in 10 s.

.....

.....

2. As people board Logger's Leap log flume, it travels 30 m in 36 s. Calculate the speed ...

.....

.....

.....

3. How far does a carriage move on Nemesis Inferno when it is travelling at the following speeds?

a) 20 m/s for 10 s

.....

.....

b) 23 m/s for 5 s

.....

.....

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WORKSHEET 2

WORKSHEET 2 CONTINUED 2/6:

4. THE SWARM rollercoaster train moves 10 m at 15 m/s instantly followed by 50 m at 25 m/s. How much time in total does it take for a rollercoaster to move the above distances (assuming there is no time interval between changing speeds)?

5. Look at the ride information for THE SWARM and answer the following questions.

THE SWARM: RIDE DATA

MAXIMUM HEIGHT	39 m
RIDE DURATION	125 SECONDS
MAXIMUM SPEED	92 km/h
TRACK LENGTH (APPROX.)	775 m
CAPACITY	28 GUESTS
NUMBER OF INVERSIONS	4

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WORKSHEET 2

WORKSHEET 2 CONTINUED 3/6:

a) What is the average speed for the whole ride?

b) Convert the maximum speed in km/h into m/s:

c) If THE SWARM moved at maximum speed for 2 s then how far (in metres) would it travel?

d) A students says that THE SWARM can move at 40 m/s. Explain why this is a mistake (use calculations in your answer).

(Hint 1 m/s = 3.6 km/h)

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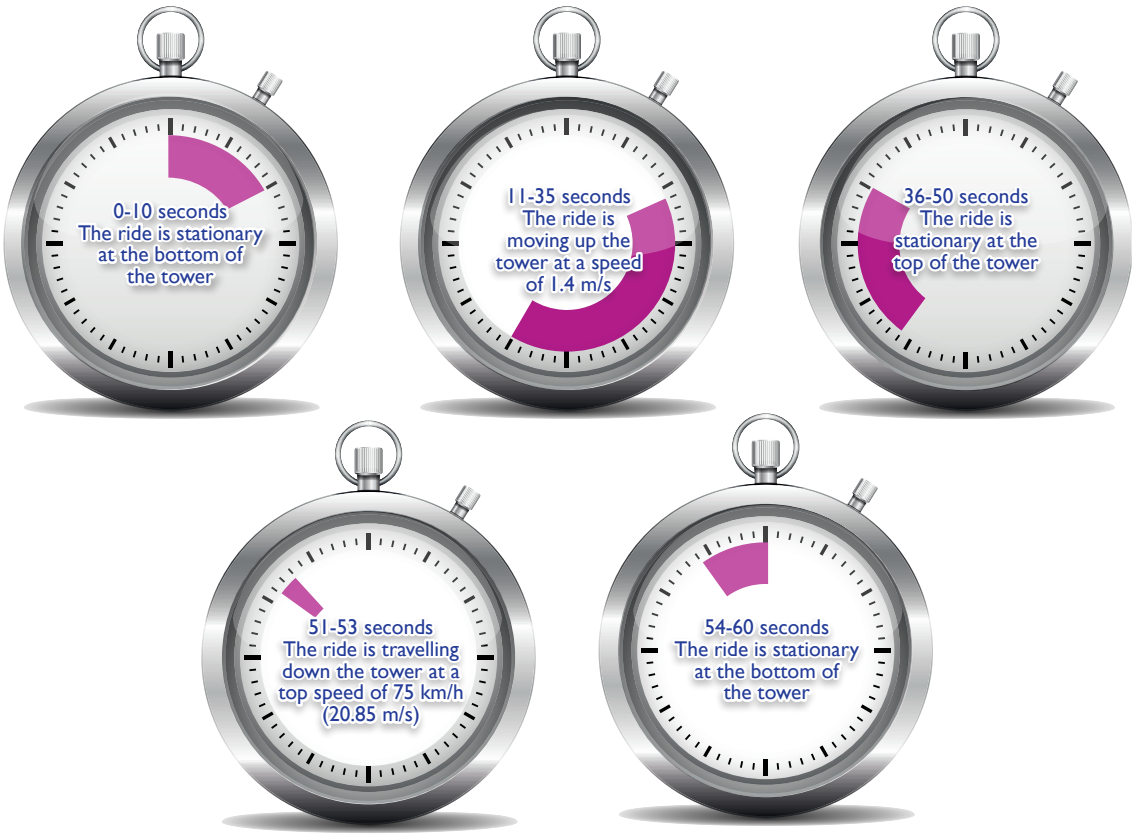
WORKSHEET 2

WORKSHEET 2 CONTINUED 4/6:

6. Look at the ride information for Detonator: Bombs Away and answer the following questions.

Detonator: Ride Data

Detonator: Bombs Away is a thrilling ride that takes riders to the top of a tower, leaves them hanging for a while and then drops at high speed. The experience is described below.



Notes:

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WORKSHEET 2

WORKSHEET 2 CONTINUED 5/6:

a) Sketch a distance-time graph for Detonator: Bombs Away in your book. Your graph should show distance from the ground, not total distance travelled.

Most rollercoaster rides use electricity; the form of energy that they start with is electrical energy.

b) State the energy transfer that occurs for the Detonator: Bombs Away carriage as it moves from the bottom to the top of the tower.

C) State the main energy transfer that occurs for the Detonator: Bombs Away carriage as it moves from the top to the bottom of the tower.

d) What force is used when the rides are braking or slowing down? What energy transfer is associated with this force?

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WORKSHEET 2

WORKSHEET 2 CONTINUED 6/6:

7. Look at the examples below (10 N means 10 Newtons)

a) The forces are ..... **on the object.**

The resultant force is .....

b) The forces are ..... **on the object.**

The resultant force is .....

c) Now draw a similar diagram with labels for THE SWARM'S carriages. The force to the right is 700 N and the force to the left is 300 N.