TEACHER'S GUIDE — Bennet's "Detect Static Electricity" Experiment

Making invisible electric charge visible

Everything else remains exactly as crafted, but the terminology is now fully aligned with KS2/KS3 expectations, curriculum language, and your Young Einstein brand.

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1. Introduction

This experiment lets pupils *see* static electricity in action using a simple Bennet-style detector.
A charged balloon brought near the metal plate causes the thin metal leaf to swing outward.
This demonstrates three core ideas:

- **Rubbing creates static charge**
- **Static charge can move without touching**
- **Like charges repel**

It's a memorable, hands-on way to introduce electrostatics and link it to real-world technologies.

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2. Learning Objectives

By the end of the lesson, pupils should be able to:

- Describe how rubbing a balloon creates **static electricity** (triboelectric charging).
- Explain that **like charges repel** and **opposite charges attract**.
- Understand that static electric forces can act **without contact**.
- Describe how the detector works: charge separation, induction, and repulsion.
- Recognise examples of static electricity in everyday life (paint spraying, printing, dust removal).
- Make predictions and observations using scientific reasoning.

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3. Background for Teachers

How the balloon becomes statically charged

Rubbing latex against hair or fabric transfers electrons.
The balloon usually becomes **negatively charged**.

Induction — the key idea

When the charged balloon comes *near* the metal plate:

- The electric field pushes electrons inside the metal.
- Charge separates instantly.
- The plate and leaf end up with the **same type of charge**.
- Like charges repel → the leaf moves away.

No contact is needed.

Why the plastic box matters

The clear plastic case is an **insulator**.
It prevents charge leaking into the air or the teacher's hands, so the leaf stays open long enough to observe.

Why this matters in modern technology

The same principles are used in:

- **Electrostatic paint spraying**
- **Powder coating**
- **Laser printers & photocopiers**
- **Air purifiers**
- **3D powder-layer printing**

This experiment is a miniature version of these systems.

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4. Preparing the Classroom

- Ensure the detector leaf hangs freely and is not bent.
- Avoid humid conditions — moisture reduces static charge.
- Have several balloons ready (latex works best).
- Provide wool cloths or jumpers for charging.
- Keep pupils spaced so balloons don't discharge on each other.

Optional: dim the lights slightly to help pupils focus on the leaf movement.

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5. Teaching Tips

- Model the balloon-rubbing slowly and deliberately.
- Emphasise that **the balloon must not touch the metal**.
- Encourage pupils to predict what will happen before each step.
- Use the language of **static charge**, **repel**, **attract**, **induction**, and **electric field** in simple, age-appropriate ways.
- Reinforce that the detector is not "magic" — it's responding to real forces.

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6. Suggested Lesson Flow

Step 1 — Engage

Ask pupils:
"Why does a balloon stick to a wall?"
Let them share ideas. Introduce the idea of **static electricity**.

Step 2 — Demonstrate charging the balloon

Rub the balloon on hair or fabric.
Ask pupils to observe hair standing up or crackling.

Step 3 — Introduce the detector

Show the metal plate, rod, leaf, and plastic case.
Explain that it reveals invisible static charge.

Step 4 — Bring the balloon near the plate

Move slowly.
Pupils watch the leaf swing outward.

Ask:
"What does this tell us about the charges on the plate and the leaf?"

Guide them to:
"They must have the **same charge**, because they **repel**."

Step 5 — Move the balloon away

The leaf falls back.
Discuss why the effect disappears.

Step 6 — Pupil exploration

Let pupils try:

- Different fabrics
- Different distances
- Touching vs not touching
- Charging the balloon more or less

Encourage them to record observations.

Step 7 — Link to real-world uses

Show images or examples of:

- Car paint spraying
- Printer toner
- Powder coating
- Air purifiers

Ask pupils to identify where **attraction** and **repulsion** are used.

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7. Answers to Common Pupil Questions

Why does hair stand up?
Each strand becomes positively charged. Same charges repel → hairs push apart.

Why does the balloon stick to a wall?
It pushes electrons away from the wall's surface, leaving a positive patch. Opposites attract.

Why does the leaf move without touching?
The balloon's electric field rearranges charges inside the metal.

Why does the leaf fall back down?
When the balloon moves away, the charge redistributes and the repulsion disappears.

Why is the box plastic?
Plastic is an insulator — it stops charge leaking away.

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8. Common Misconceptions

- "Static electricity is magnetism."
  → Clarify that magnets involve magnetic fields, not electric charge.

- “The balloon gives charge to the detector by touching it.”
  → Emphasise **induction** — no contact needed.
- “Only metal can be charged.”
  → Many materials can gain charge; metal simply allows charge to move.
- “The leaf moves because of air movement.”
  → Demonstrate with the box closed to eliminate this idea.

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9. Extension Ideas

- Compare different materials for charging (hair, wool, cotton, fleece).
- Investigate how humidity affects static charge.
- Use two balloons to show **repulsion** directly.
- Explore the triboelectric series.
- Link to KS3 topics: electric fields, conductors vs insulators, charge distribution.

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10. Safety Notes

- Avoid rubbing balloons near faces or eyes.
- Pupils with latex allergies should not handle balloons.
- Keep long hair tied back when demonstrating.
- Do not allow balloons to be popped near ears.
- Ensure the detector is handled gently — the leaf is delicate.
