Static hazards: explaining bonding and earthing

Student activity • observation and reasoning

YEAR 10 / LESSON 35 / PHYSICS ONLY

The question

Why can a small static discharge be dangerous during fuel transfer?

Use diagrams and a fictional incident sequence to explain ignition risk and the different purposes of bonding and earthing.

Equipment

- Booklet, pencil and original scenario diagrams

Diagram-based activity only. Do not use flammable liquids, vapours, ignition tests or high-voltage generators. Do not charge pupils or connect classroom equipment to mains earth sockets.

Course coverage: Physics only: 2.27P. Dangers of electrostatic charge.

Plan, model or apparatus sketch

Draw a labelled setup or force diagram; include the measured quantities.

Method and reasoning

Read the whole sequence before starting

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1. Sketch two conducting containers separated from one another. Mark a possible potential difference after charge has accumulated during material movement.

2. Explain how a discharge through air can produce a spark. Distinguish the energy in a discharge from its voltage alone.

3. Add a bonding connection between the containers to show how their potential difference can be reduced. Add a separate connection to earth and label its role.

4. Analyse an invented fuel-transfer scenario with an unconnected bonding cable. Identify the combination of flammable vapour, air and an ignition source.

5. Explain why removing one hazard does not replace the full operating procedure. Include equipment condition, suitable ventilation and trained staff, without designing a real transfer installation.

6. Write a short causal explanation from charge separation to potential difference, spark and possible ignition. Finish with the distinction between bonding and earthing.

Cleanup

- Return scenario cards and keep corrected explanations.

Record your evidence

Blank spaces are for your own work

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Reference and task data

This is a conceptual classroom case, not an operating procedure. Bonding connects conducting objects to reduce potential differences between them; earthing provides a controlled route for charge to earth. Real fuel systems need competent design and site-specific procedures.

Stage	Hazard / cause	Control and reason
Charge builds up		
Potential difference		
Possible spark		
Flammable mixture		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. What can create charge during fuel transfer?

2. Why is a spark a concern?

3. What does bonding connect?

4. What does earthing connect?

5. Does a large voltage alone establish the energy delivered?

6. Why avoid a classroom ignition demonstration?