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Plasma ball

Posted by Anonymous on Mon, 2018-09-10 16:19

Plasma ball: Are there any safety issues associated with using a plasma ball in the classroom? Sources on the internet seems to give conflicting information and I would appreciate some clarity.

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Laboratory Technicians

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plasma ball

Submitted by sat on 10 September 2018

Answer updated 18 January 2023

Plasma balls are often used to demonstrate the physics of electrical currents in school

science laboratories. They consist of a thick clear glass sphere that contains a high voltage electrode (Tesla coil) at its centre. The sphere is filled with a mixture of inert gases such as neon, argon, xenon and krypton under a partial vacuum and is powered with a low-voltage power supply. When the plasma ball is operational, beams of coloured light are produced that extend from the high voltage electrode to the outer glass sphere as the gases inside ionise^{1, 2, 3}. An electromagnetic field is also produced around the ball which diminishes with distance from the electrode⁴.

Plasma balls are generally regarded as safe devices, however, when dealing with any apparatus that generates an electric current there are several safety measures that should be implemented. Plasma balls are sources of small levels of current, static charge and electromagnetic waves that can pose a hazard for some users and certain electrical devices^{4, 5, 6}.

Safety notes on the use of plasma balls

- **Ensure that anyone who has a heart condition, medical device such as a pacemaker, implanted defibrillator, cochlear implant or hearing aid does not touch the plasma ball³.** When touched with the hand a small, current will pass from the ball to earth through the body. This current can interfere with the operation of medical electrical devices. One reference recommends that people with specific medical devices should observe from a distance of at least two metres away.⁷
- **Do not leave your hand on the ball for any length of time** as a significant amount of heat will be generated.
- **Never handle the ball with wet hands** as a shock may be produced⁶.
- **Keep electronic devices such as mobile phones and computers away from an operating plasma ball** as the frequencies that are produced may interfere with their function⁸.
- **Keep away from metal surfaces, metal objects and remove any metal jewellery before operating a plasma ball.** Touching anything metal whilst touching the ball will generate a small static shock⁶. Any metal object that touches the ball will rapidly heat up and can cause burns and fires⁸.

Some suitable activities (observing the above safety notes):

- Observe the different patterns created by placing:
 - One finger; or all your fingertips or your whole palm on the plasma ball
 - Your hands in different positions on the plasma ball
- Observe a fluorescent tube illuminating:
 - Hold one end of the glass part of a fluorescent tube (NOT the metal cap) and bring the tube close to and gently rest the other end (NOT the metal cap) on the plasma ball.

References and further reading:

¹ Science Struck. 'An Introduction: What is a Plasma Ball and How Does it Work?', Retrieved (18 January 2023) Science Struck website, <https://sciencestruck.com/what-is-plasma-ball-how-does-it-work>

² University of Wisconsin –Madison The Wonders of Physics Traveling Outreach Program. (2008). 'Plasma Ball Experiments', Retrieved from University of Wisconsin –Madison The Wonders of Physics Traveling Outreach Program website: <https://wonders.physics.wisc.edu/plasma-ball-experiments/> (Download the pdf version with teacher notes)

³ CLEAPSS. 2015. *GL 194 Using a plasma ball*. CLEAPSS website <https://science.cleapss.org.uk/Resource-Info/GL194-Using-a-plasma-ball.aspx> (Login required.)

⁴ 'González, J.Y. 2016. 'Plasma: The fourth state', Science in school European journal for science teachers. Issue 37. Retrieved from Science in School website: <https://www.scienceinschool.org/article/2016/plasma-fourth-state/> (download pdf of article)

⁵ University of Illinois. 2007. 'Physics Van – Plasma Balls and Tesla Coils'. Retrieved (18 January 2023) from University of Illinois Physics Van website, <https://van.physics.illinois.edu/ask/listing/2282>

⁶ Specialty Toys Direct. n.d. *Plasma Globe Owner's Guide*, Specialty Toys Direct website, Retrieved (18 January 2023) from <https://www.stdi.ca/amazon/plasma-globes/Plasma%20Globe%20Owners%20Guide%20-%20Web.pdf>

⁷ Reiland, Robert. 2007. *Plasma Globes and "Body Capacitance"*. Retrieved (18 January 2023) from Contemporary Physics Education Project website: <https://newsite.cpepphysics.org/wp-content/uploads/2021/10/Plasma-Globes-and-Body-Capacitance-Student.pdf> go to <https://newsite.cpepphysics.org/elementor-1229/> to create a login to access further resources.

⁸ Janet B. (2017, April 25) 'Plasma Ball Tricks', Retrieved from Sciencing.com website, <https://sciencing.com/plasma-ball-tricks-7613499.html>

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