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Q95

**With reference to 'fuel cells' in which hydrogen-rich fuel and oxygen are used to generate electricity, consider the following statements: 1. If pure hydrogen is used as a fuel, the fuel cell emits heat and water as by-products. 2. Fuel cells can be used for powering buildings and not for small devices like laptop computers. 3. Fuel cells produce electricity in the form of Alternating Current (AC). Which of the statements given above is/are correct? (a) 1 only (b) 2 and 3 only (c) 1 and 3 only (d) 1, 2 and 3 Official key: A.**

UPSC Civil Services Prelims 2015 · General Studies · 2 marks · Science and Technology

Science, technology, space, defence, IT - Prelims GS Paper I.

**Explanation****(a) Official key**

- **Statement 1 is correct:** a hydrogen-oxygen fuel cell yields electricity, heat and water. Statements 2 and 3 are false: fuel cells can power small devices, and they generate direct current, not AC. Hence 1 only is the official key.

**(b)**

Statements 2 and 3 are both wrong, so this pair is not the key.

**(c)**

Statement 3 is wrong (output is DC), so 1 and 3 cannot stand together. This option is not the key.

**(d)**

All three would require 2 and 3 to be true. They are not. This option is not the key.

**Summary**

- **Official key is (a) 1 only. Pure-hydrogen fuel cells are clean:** water and heat as by-products. They already power laptops, phones and vehicles at small scale, so statement 2 fails. Electrochemical cells produce DC; AC would need an inverter, so statement 3 fails. Only statement 1 survives.

**Related possible facts**

These can be asked in a future Prelims paper.

**PEM fuel cell**

Proton-exchange membrane; common for vehicles and portables

**Reaction**

$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{electrical energy} + \text{heat}$

**DC output**

Inverter needed for AC grids or AC motors in some designs

**Hydrogen sources**

Reformed hydrocarbons still emit CO<sub>2</sub> upstream; pure H<sub>2</sub> cell does not at the stack

**ISRO / DRDO**

Indian fuel-cell research for space and defence applications

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