1. **Select the correct statement(s) from the list below**

- [ ] Werner von Siemens is credited as the inventor of the selenium solar cell
- [ ] The first silicon solar array was installed in 1884 on a New York rooftop
- [x] Albert Einstein earned the Nobel prize in physics based on his work on the photoelectric effect

Correct

In **1905** Albert Einstein publishes a paper explaining the **photoelectric effect on a quantum basis** later earning him a Nobel prize in physics.

- [x] Silicon solar cells where invented in the 1950s at Bell labs

Correct

The birth of the modern solar cell occurred along with that of the silicon transistor. Two scientists, Calvin Fuller and Gerald Pearson of the famous **Bell Laboratories**, led the pioneering effort that took the **silicon transistor** from theory to working device. Their work led to the invention of the **silicon solar cell**.

2. **Solar cell power output**

Calculate the power output of a $1m^2$ solar cell with an efficiency of 0.5% assuming $1000W/m^2$ of illumination.

Please give the answer in watts (W), do NOT write the units (example answer 8.3).

5

Correct

That is correct.

An easy way to realize if each term should be multiplied or divided is to think about weather or not the term increases or decreases the result. Let us go through each term one at a time:

- **Area:** For a larger area the solar cells should produce more power.
- **Efficiency**: A higher efficiency means more power output.
- **Illumination power**: more illumination power means more power output.

From the above list **we can conjecture that the result we are looking for is the product of all three numbers**.

3. **Solar cell efficiency**

Please provide the formula to calculate the efficiency of a solar cell given the input power ($\mathbf{P_{in}}$) and the power output of the solar cell ($\mathbf{P_{out}}$)

*Write P_{in} as **P_in** and P_{out} as **P_out***

Preview
$\frac{P_{out}}{P_{in}}$
Please note: Each of the following will be interpreted as a single variable, not as a product of variables: P_in, P_out. To multiply variables, please use * (e.g. enter x*y to multiply variables x and y).

P_out/P_in

✓ **Correct**
That is correct. The power conversion efficiency is calculated as

$$\eta = \frac{P_{out}}{P_{in}}$$

4. **Efficiency calculation**

Calculate the efficiency of a 0.5 m^2 solar panel producing 20 W. Assume that the power input is 500W.

Please give the answer in percentage (%), do NOT write the units (example answer 8.3).

4

✓ **Correct**
That is correct. The efficiency is calculated as

$$\eta = \frac{P_{out}}{P_{in}}$$

5. **Which application was the driving force that ensure the adaptation of the technology?**

Please provide a written answer

Renewable energy

✓ **Correct**

Silicon solar cells where hampered by high production costs in the early years of their development and the primary market that saw adaptation was in space applications. The first spacecraft to use solar panels was the Vanguard 1 satellite, launched by the US in 1958 and since then the main power source for most Earth orbiting satellites have been solar cells, as they offer the best **power-to-weight ratio**. This success was driven by the need and the willingness to pay for the best possible solar cells for satellites.