1. **What type of silicon solar cell is depicted?**

- ○ Monocrystalline silicon solar cell
- ◉ Multicrystalline silicon solar cell
- ○ Amorphous silicon solar cell

✓ **Correct**
That is correct

The important difference is non uniform reflection from the surface of the solar cells . There are distinct areas with different reflections caused by the different crystal domains in the multicrystalline silicon.

2. **Why do we use silicon for solar cells?**

Select the correct reason(s) that silicon solar cells have become a dominating solar cell technology.

- [ ] It is the most efficient solar cell technology
- [x] The bandgap of silicon is suitable for solar cells

Correct
That is correct

The bandgap of silicon is quit suitable for solar cells. The theoretical efficiency of solar cells depend on the size of the bandgap, since photons with lower energy than the bandgap, are not absorbed. Photons with higher energy does not contribute with their energy that exceeds the bandgap. This means that a theoretical maximum exists, and while the bandgap of silicon is slightly lower than idea, it is still quit suitable for solar cells.

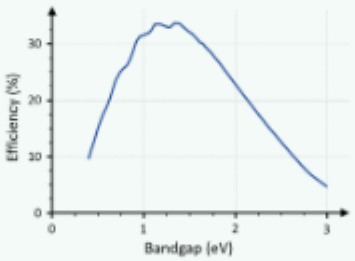

Figure 1. The Shockley-Queisser limit for the efficiency of a solar cell.

- [x] Silicon is an abundant material

Correct
That is correct

Silicon is the second most abundant material in the Earth's crust. However, most silicon is bound in the form of silicon dioxide, and therefore we need a lot of energy to separate.

3. The four photons in the illustration (figure 1) each create an electron hole pair, and depending on the position of the absorption event there are different probabilities of the photons to contribute to the current produced by the solar cell.

Which photon has the best chance of contributing to the photocurrent?

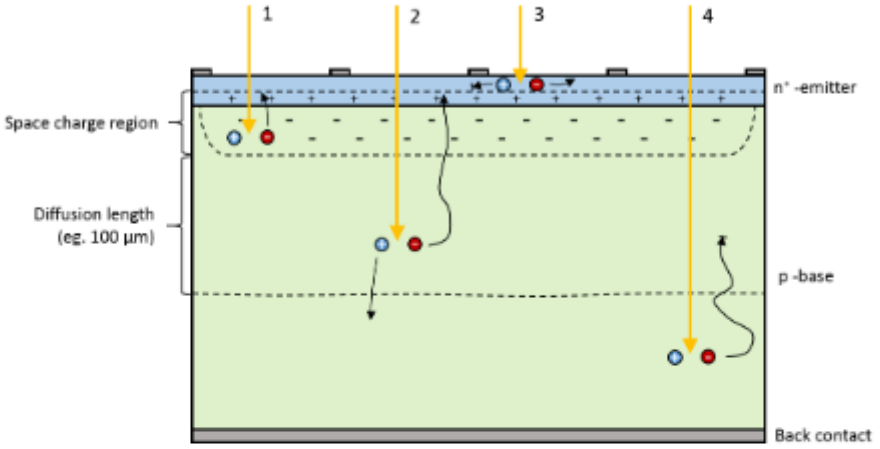

Figure 1. Cross section of a crystalline silicon solar cell. The four different electron-hole pairs indicated have different probabilities of contributing to the photocurrent.

- (●) Photon 1
- ( ) Photon 2
- ( ) Photon 3
- ( ) Photon 4

✓ **Correct**

That is correct

Photon 1 is absorbed within the space charge region. The field prevailing in the space charge region separates the generated electron-hole pair and drives the two charge carriers in different directions. The hole must travel a relatively long way through the base to the plus contact, however, as it is in the p-region during this movement, the probability of a recombination is small. Therefore, **almost all generated electron-hole pairs generated in the space charge region can be used for the photocurrent**.

4. Explain the difference between mono and multicrystalline silicon in terms of production methods and solar cell efficiency.

Mono crystalline solar cells are more efficient because they are cut from a single source of silicon. Multi crystalline solar cells are blended from multiple silicon sources and are slightly less efficient.

✓ **Correct**

Monocrystalline silicon wafers are produced typically through the Czochralski process creating a single crystal.

Multicrystalline silicon wafers on the other hand is made by slowly cooling a crucible containing molten silicon. Column growth ensures that large crystal domains are formed.

The crystal domains of multicrystalline gives rise to recombination losses at boundaries. Therefore the efficiency of multicrystalline silicon solar cells is typically lower than monocrystalline silicon solar cells.