**Science Learning with an AI Assistant: Answer Sheet**

Computer ID: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part I: Find the Optimal Tilt Angle for a Winter Day**

**Table 1: Your First Try (Winter Condition)**

|  |  |
| --- | --- |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kWh** |
| How confident are you with your solution? [ ]  Very much [ ]  Somewhat [ ]  Not really Why do you think the tilt angle you chose would maximize the energy output? Use the following concept(s) to explain, if applicable: * The Sun path:
* Seasonal change:
* Daytime length:
* The projection effect:

 **(4pts)** |
|

**Table 2: Alice’s First Try**

|  |  |
| --- | --- |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kWh** (round to 2 decimal places) |
| Are you surprised by Alice’s solution? [ ]  Very much [ ]  Somewhat [ ]  Not really If yes, what surprised you? If not, why wasn’t it surprising? Use all possible science concepts (e.g., the Sun path, seasonal change, daytime length, and the projection effect) to explain Alice’s solution.  **(4pts)** |

**Table 3: Results of Iteration**

|  |  |
| --- | --- |
| **Your Try #2** |  |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kWh** |
| What was your strategy to improve? Please describe how your strategy changed from your previous try and how Alice influenced it. If it did not change, write “same strategy as before.” **(4pts)**  |
|
| **Alice’s Try #2** |  |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kWh** (round to 2 decimal places) |
| Are you surprised by Alice in this round? [ ]  Very much [ ]  Somewhat [ ]  Not reallyIf yes, what surprised you? If not, why wasn’t it surprising? Use all possible science concepts (e.g., the Sun path, seasonal change, daytime length, and the projection effect) to explain Alice’s solution. **(4pts)**  |
|
| **Your Try #3** |  |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kWh** |
| What was your strategy to improve? Please describe how your strategy changed from your previous try and how Alice influenced it. If it did not change, write “same strategy as before.” **(4pts)** |
|
| **Alice’s Try #3** |  |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_kWh** (round to 2 decimal places) |
| Are you surprised by Alice in this round? [ ]  Very much [ ]  Somewhat [ ]  Not reallyIf yes, what surprised you? If not, why wasn’t it surprising? Use all possible science concepts (e.g., the Sun path, seasonal change, daytime length, and the projection effect) to explain Alice’s solution.  **(4pts)** |
|
| **Your Try #4** |  |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_kWh** |
| What was your strategy to improve? Please describe how your strategy changed from your previous try and how Alice influenced it. If it did not change, write “same strategy as before.” **(4pts)** |
|
| **Alice’s Try #4** |  |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_kWh** (round to 2 decimal places) |
| Are you surprised by Alice in this round? [ ]  Very much [ ]  Somewhat [ ]  Not really If yes, what surprised you? If not, why wasn’t it surprising? Use all possible science concepts (e.g., the Sun path, seasonal change, daytime length, and the projection effect) to explain Alice’s solution.  **(4pts)** |
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| --- |
| **Winter Day Final Results** |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_kWh** (round to 2 decimal places) |

 **Part I Scores (Out of 32 points) \_\_\_\_\_\_\_**

(This area is for the instructor.)

**Part II: Find the Optimal Tilt Angle for a Summer Day**

Describe below how the output of a solar panel array may be different on a summer day, compared with a winter day. Use all possible concepts (e.g., Sun path, seasonal change, daytime length, and projection effect) to rationalize your theory.

**Table 4: Results of Iteration (Summer Condition)**

|  |  |
| --- | --- |
| **Your Try #1** |  |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_ kWh** |
| Why do you think the tilt angle you chose would maximize energy output on June 22? Use all possible concepts (e.g., the Sun path, seasonal change, daytime length, and the projection effect) to explain how they may affect the output and describe how they have informed your choice. **(4pts)** |
|
| **Alice’s Try #1** |  |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_ kWh** (round to 2 decimal places) |
| Are you surprised by Alice’s solution? [ ]  Very much [ ]  Somewhat [ ]  Not reallyIf yes, what surprised you? If not, why wasn’t it surprising? Use all possible science concepts (e.g., the Sun path, seasonal change, daytime length, and the projection effect) to explain Alice’s solution. **(4pts)** |
|
| **Your Try #2** |  |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_ kWh** |
| What was your strategy to improve? Please describe how your strategy changed from your previous try and how Alice influenced it. If it did not change, write “same strategy as before.”**(4pts)** |
|
| **Alice’s Try #2** |  |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_ kWh** (round to 2 decimal places) |
| Are you surprised by Alice in this round? [ ]  Very much [ ]  Somewhat [ ]  Not reallyIf yes, what surprised you? If not, why wasn’t it surprising? Use all possible science concepts (e.g., the Sun path, seasonal change, daytime length, and the projection effect) to explain Alice’s solution. **(4pts)** |
|
| **Your Try #3** |  |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_ kWh** |
| What was your strategy to improve? Please describe how your strategy changed from your previous try and how Alice influenced it. If it did not change, write “same strategy as before.”**(4pts)** |
|
| **Alice’s Try #3** |  |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_ kWh** (round to 2 decimal places) |
| Are you surprised by Alice in this round? [ ]  Very much [ ]  Somewhat [ ]  Not reallyIf yes, what surprised you? If not, why wasn’t it surprising? Use all possible science concepts (e.g., the Sun path, seasonal change, daytime length, and the projection effect) to explain Alice’s solution. **(4pts)** |
|
| **Your Try #4** |  |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_ kWh** |
| What was your strategy to improve? Please describe how your strategy changed from your previous try and how Alice influenced it. If it did not change, write “same strategy as before.”**(4pts)** |
|
| **Alice’s Try #4** |  |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_ kWh** (round to 2 decimal places) |
| Are you surprised by Alice in this round? [ ]  Very much [ ]  Somewhat [ ]  Not reallyIf yes, what surprised you? If not, why wasn’t it surprising? Use all possible science concepts (e.g., the Sun path, seasonal change, daytime length, and the projection effect) to explain Alice’s solution. **(4pts)** |
|

|  |
| --- |
| **Summer Day Final Results** |
| **Tilt Angle \_\_\_\_\_ °** | **Daily Output \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_kWh** (round to 2 decimal places) |

**Part II Scores (Out of 32 points) \_\_\_\_\_\_\_**

(This area is for the instructor.)

**Summary Questions**

* + - 1. How do you explain the final optimal tilt angle for a summer day in Miami? Use all the four concepts, including the Sun path, seasonal change, daytime length, and the projection effect, in your explanation. **(18 pts)**
1. Would the optimal tilt angles change for June 22nd and December 22nd if the solar array were moved to Boston, Massachusetts (which has a higher latitude than Miami, Florida), respectively? Explain using all possible concepts (e.g., Sun path, seasonal change, daytime length, and projection effect) you have learned. **(18 pts)**

**Summary Questions Scores (Out of 36 points) \_\_\_\_\_\_\_\_**

**Total Scores (Out of 100 points) \_\_\_\_\_\_\_\_**

(This area is for the instructor.)