

Solar Car Engineering Challenge— Part 1

In this lab students will build, measure, and test solar cars. After testing the original car models for speed and acceleration (advanced students), students will try and improve their original design. Students will complete all parts of the engineering process.

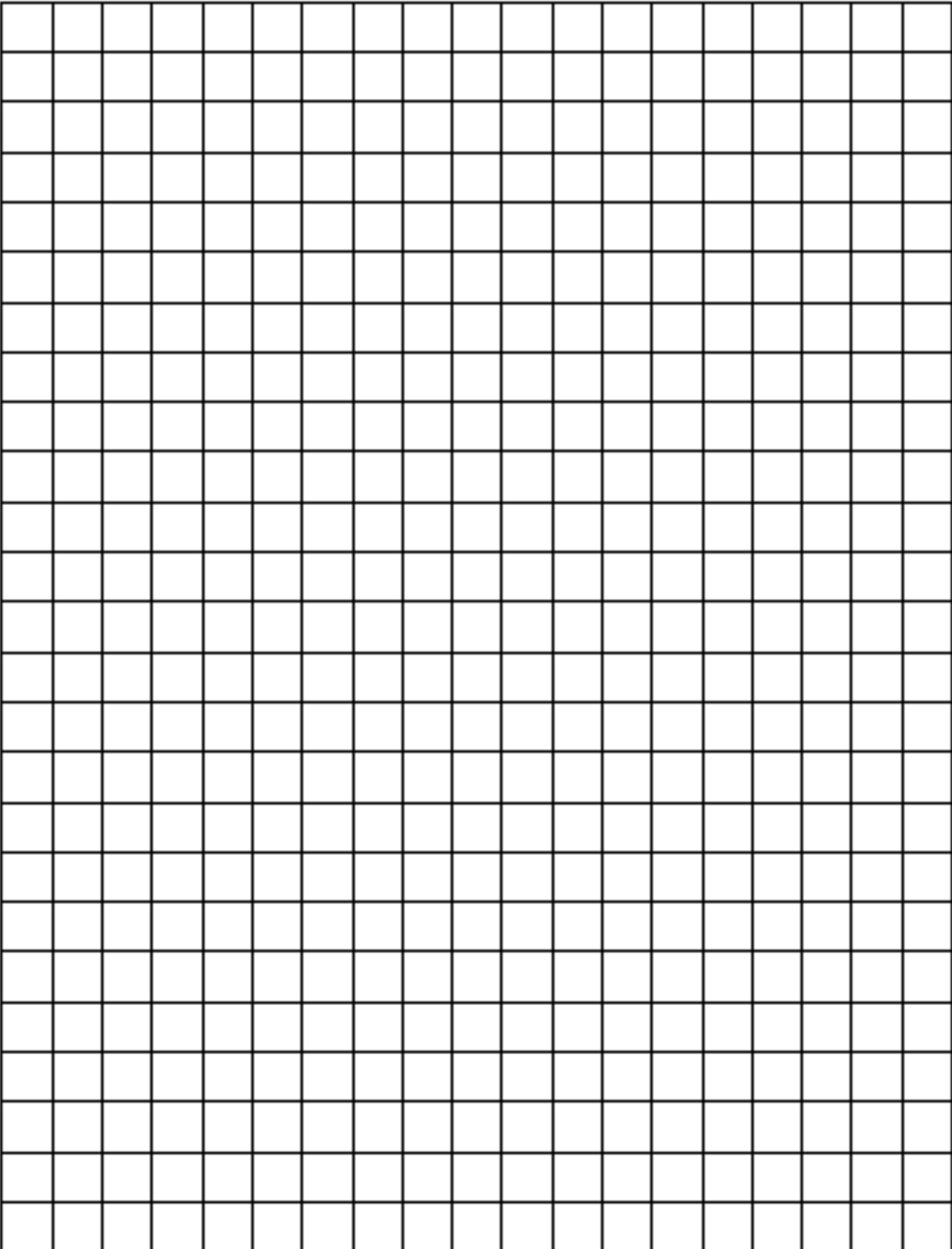
Building the Sol Run Cars

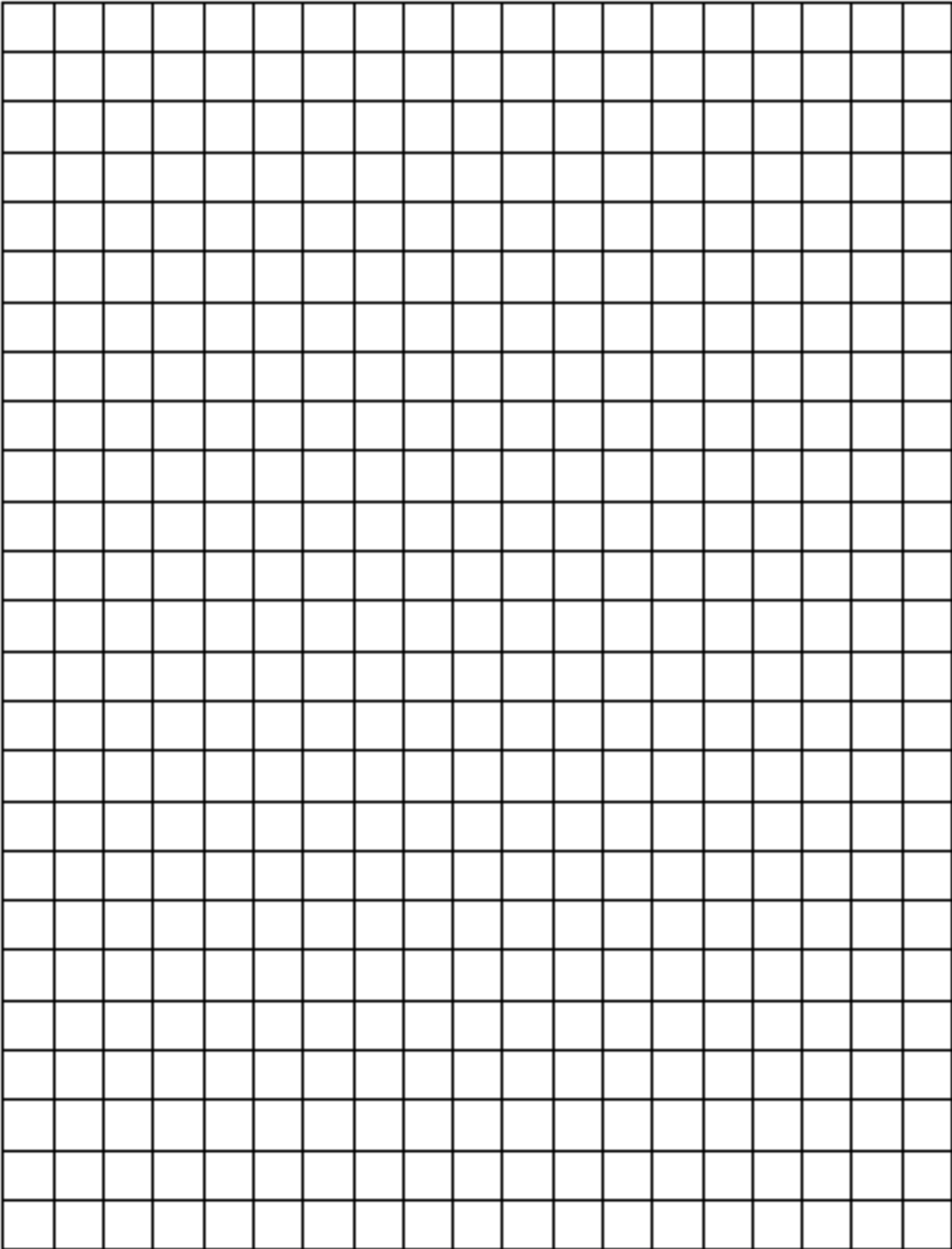
1. Students should review the Sol Run Handout and read through the pamphlet a few times before gathering any materials. They should build the car as it is pictured/described in the handout so that all students are starting with the same original design.
2. Students should gather all materials. To make this easier, separate all of the materials into cardboard box tops—the materials are contained and students can see them a bit easier. Have one student pick up the parts for each lab group (3-4 students).
3. After students have gathered their materials they should complete the inventory checklist below to determine the budget of their initial project.

Solar Car Budget Sheet—1

| Part Name— Description | Amount | Unit Cost | Total Cost |
|------------------------------|--------|---------------------------|------------|
| Large Wheels | | \$300.00 | |
| Medium Wheels | | \$200.00 | |
| Small Wheels | | \$100.00 | |
| Motor | | \$1,000.00 | |
| Motor Holder | | \$100.00 | |
| Wires (10 cm) | | \$10.00/10cm | |
| Alligator Clips | | \$100.00 | |
| Solar Panel (1.5 V) | | \$500.00 | |
| Screw Eye | | \$25.00 | |
| Small Gear | | \$50.00 | |
| Large Gear | | \$100.00 | |
| Shafts/Pre-cut Axles (10 cm) | | \$250.00 | |
| Rubber Band | | \$50.00 | |
| Sandpaper | | \$50.00/10cm ² | |
| Wood Blocks | | \$200.00 | |
| Car Body | | \$1,000.00 | |
| Labor (Time Building Car) | | \$100.00/hr | |
| Total Cost of Car 1 | | | |

4. Students should follow the instructions provided and build their solar car. After students build their car they need to use the graph paper provided to sketch front, rear and side profiles (to scale).





Solar Car Data

| Car Dimension | Measurement (cm) |
|---------------|------------------|
| Length | |
| Width | |
| Height | |
| Mass | |

Testing the Sol Run Cars

After their car is functional, students will test them on 2-meter tracks. They will complete three trials (minimum) and use the data that is collected to find the average speed of their solar car.

Calculating Speed

$$\text{Speed} = \text{distance}/\text{time}$$

Solar Car Test Data

| Trial | Distance | Time | Speed |
|-------|----------|------|-------|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |

(Extension) Advanced students can calculate acceleration of the car at different points in the test run. Have them explain how they will do this and provide their data below.

Solar Car Engineering Challenge–Part 2

After building, measuring, and testing the Sol Run car, students will meet as a group and brainstorm ways to improve the car’s speed. After they have listed/discussed improvement options they will use computers to research ways to improve the car’s performance. **Students may only use two motors and two solar panels in their final designs.**

Brainstorming Ideas (Words and/or Diagrams)

| | | |
|---------------|---------------|---------------|
| Idea 1 | Idea 2 | Idea 3 |
| Pros | Pros | Pros |
| Cons | Cons | Cons |

As a group decide which ideas above will improve the speed of the solar car. List them below. Use these ideas as a guide for computer research.

Provide Rough Sketches for Updated Solar Car

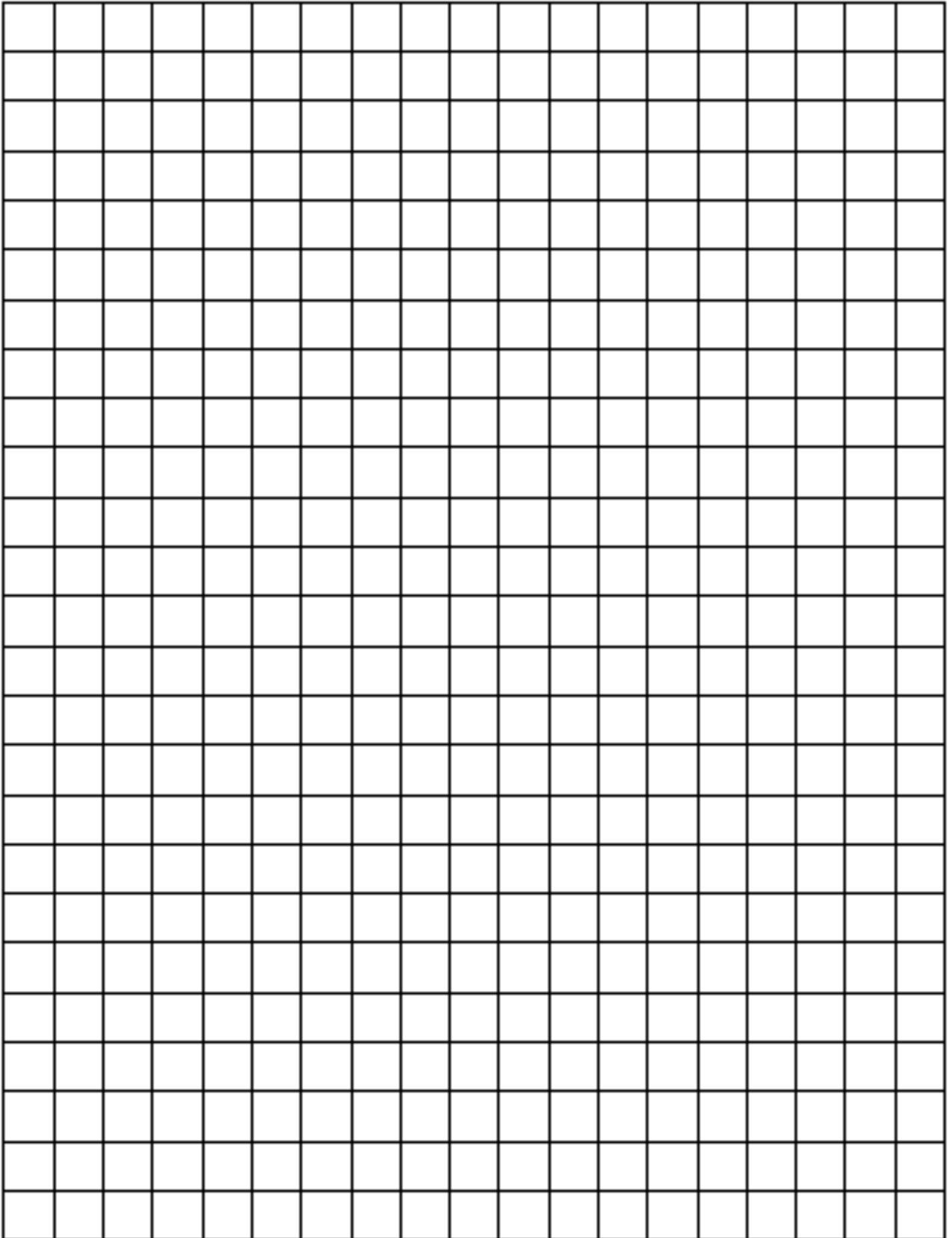
| | |
|---|---|
| <p style="text-align: center;">Top Profile</p> | <p style="text-align: center;">Notes</p> |
| <p style="text-align: center;">Side Profile</p> | <p style="text-align: center;">Notes</p> |
| <p style="text-align: center;">Front Profile</p> | <p style="text-align: center;">Notes</p> |

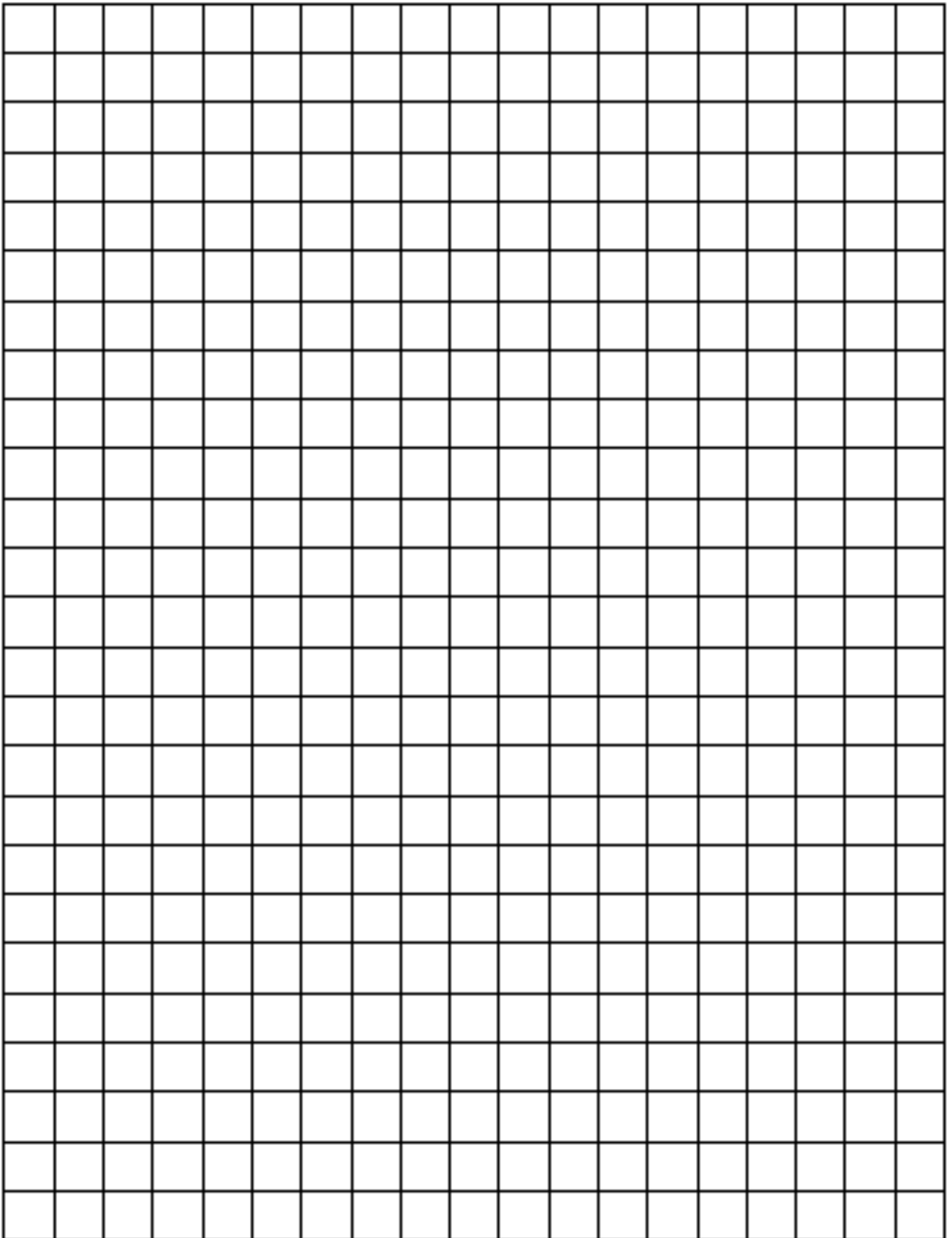
After students have determined what improvements are to be made and gathered their materials, they should complete the inventory checklist below to determine the budget of their second project. If a material isn't listed, the student should add it to the budget sheet and talk to their teacher so they can assign an amount and cost.

Solar Car Budget Sheet–1

| Part Name— Description | Amount | Unit Cost | Total Cost |
|------------------------------|--------|---------------------------|------------|
| Large Wheels | | \$300.00 | |
| Medium Wheels | | \$200.00 | |
| Small Wheels | | \$100.00 | |
| Motor | | \$1,000.00 | |
| Motor Holder | | \$100.00 | |
| Wires (10 cm) | | \$10.00/10cm | |
| Alligator Clips | | \$100.00 | |
| Solar Panel (1.5 V) | | \$500.00 | |
| Screw Eye | | \$25.00 | |
| Small Gear | | \$50.00 | |
| Large Gear | | \$100.00 | |
| Shafts/Pre-cut Axles (10 cm) | | \$250.00 | |
| Rubber Band | | \$50.00 | |
| Sandpaper | | \$50.00/10cm ² | |
| Wood Blocks | | \$200.00 | |
| Car Body | | \$1,000.00 | |
| Labor (Time Building Car) | | \$100.00/hr | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Total Cost of Car 2 | | | |

Provide accurate, neat, scaled drawings of car #2 (provide front, tops, and side views)





Solar Car Data

| Car Dimension | Measurement (cm) |
|---------------|------------------|
| Length | |
| Width | |
| Height | |
| Mass | |

Testing the Improved Sol Run Cars

After the cars are functional, students will test them on 2-meter tracks. They will complete three trials (minimum) and use the data that is collected to find the average speed of their solar cars.

Calculating Speed

$$\text{Speed} = \text{distance}/\text{time}$$

Solar Car Test Data

| Trial | Distance | Time | Speed |
|-------|----------|------|-------|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |

(Extension) Advanced students can calculate acceleration of the car at different points in the test run. Have them explain how they will do this and provide their data below.

Analysis and Conclusion

What changes did you need to make to your first design and why?

Describe what happened when you tested your prototype and propose explanations for what happened using information from your background info/research.

Using the data collected, calculate the percent change between car 1 and car 2 (show your work).

What were the strengths of your final design?

What were the weaknesses of your final design?

What improvements need to be made to your second design?