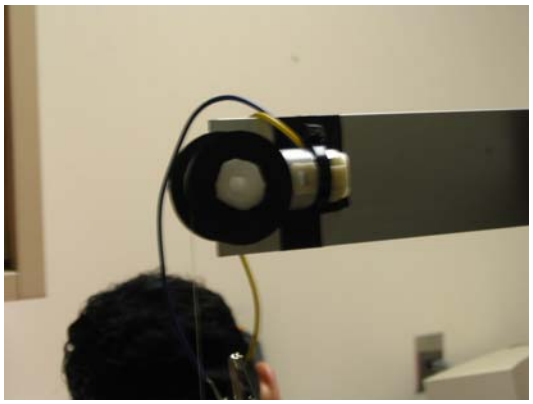
Design Competition Results
Includes photos shot during the competition and Team Report Submitted by the Team.

# Team 6

Wheel radius = 15 mm
Mass lifted = 365.1
Height achieved = 4 ft.
Time used = 3:45 (m:sec)



Design used a pair of the smaller white wheels glued together with black rims added:



Design used series connection of solar cells to achieve higher voltage:



Design used water in bottles to provide weight adjustments:



View of height being measured:



The weight in the bottles was rapidly adjusted!!: (see top of next column)

# Solar Cell Design competition

**TEAM**: Juan Molina and Robert Ochs
**DESIGN PLAN**: The design plan for the competition is to use three solar cells (see fig 1) connected in series for a higher output power, a DC Gear Motor (see fig 2), and 2 wheels/gears for torque reduction and expansion for slow and high velocity outputs in this way we can lift more weight at a slower time.
**METODS**: The solar cells are connected in series using clippers then the ends of this cicuit connected to the DC motor. To the shaft of the DC motor we connect the small gear. We want to use the small gear because it gives us more torque and more speed so we can lift the weight at less time. To the shaft we connect a string that has at the end the weights. The cells will give us approximately 1.5 Volts. Some of the properties of the cells are illustrated in figure 3.

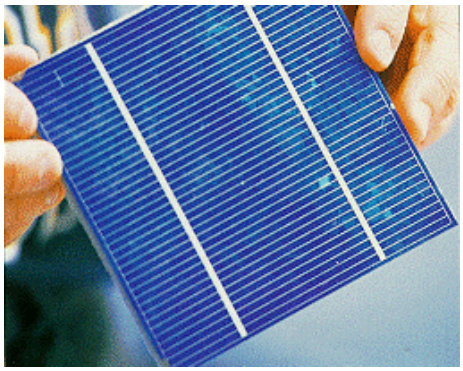


**Figure 1. Solar Cell**



**Figure 2. This 143:1 gearmotor is much like the GM3 gearmotor but runs at nearly twice the speed. This motor goes 66RPM at 5V, drawing 670mA at stall while providing 43 in*oz torque. Free running at at 5 volts is 73.2mA.**
**With a 7mm double-flat output shaft (there is no output on the other side), and a built-in clutch and built-in mounting screw holes, you can see why we like these motors!**
**These units have an overall size of 70.5mm (2.78") x 27mm (1.06") x 23mm (0.906") thick.**

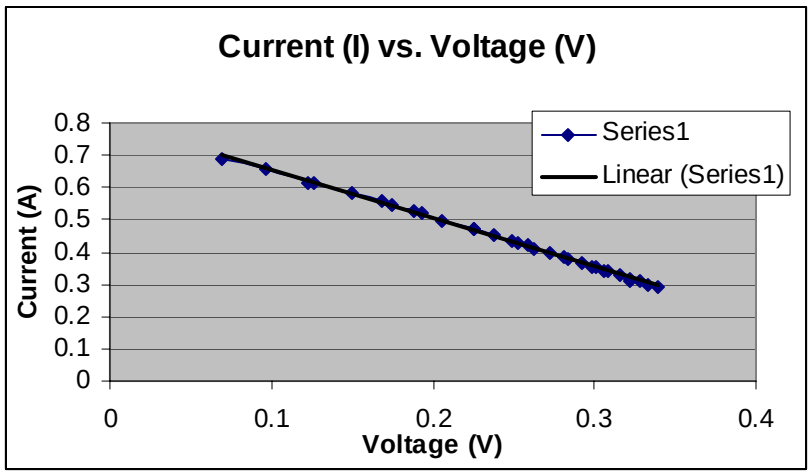



**Figure 3. IV curve for one of the solar cells. As you can see as the voltage increases the current decreases voltage increases**

| V | I | P | 3 series cells V series | 3 parallel cells I parallel | Power series | Power Parallel |
|---|---|---|---|---|---|---|
| 37 | 747 | 0.027639 | 111 | 2241 | 0.082917 | 0.082917 |
| 73 | 720 | 0.05256 | 219 | 2160 | 0.15768 | 0.15768 |
| | | | | | | |
| 101 | 694 | 0.070094 | 303 | 2082 | 0.210282 | 0.210282 |
| 135 | 657 | 0.088695 | 405 | 1971 | 0.266085 | 0.266085 |
| 131 | 661 | 0.086591 | 393 | 1983 | 0.259773 | 0.259773 |
| 160 | 628 | 0.10048 | 480 | 1884 | 0.30144 | 0.30144 |
| 179 | 603 | 0.107937 | 537 | 1809 | 0.323811 | 0.323811 |
| 189 | 589 | 0.111321 | 567 | 1767 | 0.333963 | 0.333963 |
| 216 | 552 | 0.119232 | 648 | 1656 | 0.357696 | 0.357696 |
| 218 | 548 | 0.119464 | 654 | 1644 | 0.358392 | 0.358392 |
| 230 | 529 | 0.12167 | 690 | 1587 | 0.36501 | 0.36501 |
| 247 | 504 | 0.124488 | 741 | 1512 | 0.373464 | 0.373464 |
| 245 | 506 | 0.12397 | 735 | 1518 | 0.37191 | 0.37191 |
| 261 | 482 | 0.125802 | 783 | 1446 | 0.377406 | 0.377406 |
| 270 | 465 | 0.12555 | 810 | 1395 | 0.37665 | 0.37665 |
| 277 | 452 | 0.125204 | 831 | 1356 | 0.375612 | 0.375612 |
| 282 | 447 | 0.126054 | 846 | 1341 | 0.378162 | 0.378162 |
| 284 | 437 | 0.124108 | 852 | 1311 | 0.372324 | 0.372324 |
| 304 | 408 | 0.124032 | 912 | 1224 | 0.372096 | 0.372096 |
| 315 | 391 | 0.123165 | 945 | 1173 | 0.369495 | 0.369495 |
| 308 | 400 | 0.1232 | 924 | 1200 | 0.3696 | 0.3696 |
| 318 | 383 | 0.121794 | 954 | 1149 | 0.365382 | 0.365382 |
| 324 | 371 | 0.120204 | 972 | 1113 | 0.360612 | 0.360612 |
| 327 | 370 | 0.12099 | 981 | 1110 | 0.36297 | 0.36297 |
| 328 | 363 | 0.119064 | 984 | 1089 | 0.357192 | 0.357192 |
| 331 | 358 | 0.118498 | 993 | 1074 | 0.355494 | 0.355494 |
| 337 | 347 | 0.116939 | 1011 | 1041 | 0.350817 | 0.350817 |
| 343 | 335 | 0.114905 | 1029 | 1005 | 0.344715 | 0.344715 |
| 343 | 336 | 0.115248 | 1029 | 1008 | 0.345744 | 0.345744 |
| 349 | 325 | 0.113425 | 1047 | 975 | 0.340275 | 0.340275 |
| 355 | 316 | 0.11218 | 1065 | 948 | 0.33654 | 0.33654 |
| 360 | 307 | 0.11052 | 1080 | 921 | 0.33156 | 0.33156 |

density of water = 998.23 kg/m3

diameter of wheel about = 3 cm = .03 m

.5 liter = 5E-4 m3

| liters | cubic meters | mass(kg) | force(N) = mg | Torque required (N*m) |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 0.05 | 0.00005 | 0.049912 | 0.489133 | 0.014674 |
| 0.1 | 0.0001 | 0.099823 | 0.978265 | 0.029348 |
| 0.15 | 0.00015 | 0.149735 | 1.467398 | 0.044022 |
| 0.2 | 0.0002 | 0.199646 | 1.956531 | 0.058696 |
| 0.25 | 0.00025 | 0.249558 | 2.445664 | 0.07337 |
| 0.3 | 0.0003 | 0.299469 | 2.934796 | 0.088044 |
| 0.35 | 0.00035 | 0.349381 | 3.423929 | 0.102718 |
| 0.4 | 0.0004 | 0.399292 | 3.913062 | 0.117392 |
| 0.45 | 0.00045 | 0.449204 | 4.402194 | 0.132066 |
| 0.5 | 0.0005 | 0.499115 | 4.891327 | 0.14674 |
| 0.55 | 0.00055 | 0.549027 | 5.38046 | 0.161414 |
| 0.6 | 0.0006 | 0.598938 | 5.869592 | 0.176088 |
| 0.65 | 0.00065 | 0.64885 | 6.358725 | 0.190762 |
| 0.7 | 0.0007 | 0.698761 | 6.847858 | 0.205436 |
| 0.75 | 0.00075 | 0.748673 | 7.336991 | 0.22011 |
| 0.8 | 0.0008 | 0.798584 | 7.826123 | 0.234784 |
| 0.85 | 0.00085 | 0.848496 | 8.315256 | 0.249458 |
| 0.9 | 0.0009 | 0.898407 | 8.804389 | 0.264132 |
| 0.95 | 0.00095 | 0.948319 | 9.293521 | 0.278806 |
| 1 | 0.001 | 0.99823 | 9.782654 | 0.29348 |

