**Dynamic Design:
Launch and Propulsion**

Measuring Altitude

STUDENT ACTIVITY

MATERIALS

- Altitude tracker
- Scissors
- Pin or small nail
- Thread, lightweight string, or fishing line
- Cellophane tape
- Small washer or 1-2 ounce fishing sinker

PROCEDURE

Constructing an Altitude Tracker

1. Cut out the altitude tracker along the SOLID lines.
2. Fold along the dotted lines.
3. Roll the hatched area at the top of the tracker into a tube and tape the folded edge to the side of the tracker.
4. Shape the tube into a sighting tube.
5. Use a pin or a small nail to punch a hole where indicated.
6. Slip a thread, string, or fishing line through the hole and knot it on the back (no print) side.
7. Cut the thread, string, or fishing line to 20 centimeters in length.
8. Tie the washer or sinker to the end of the string.

Measuring Altitude

1. Find an object whose height you would like to know but cannot measure directly.
2. Stand 10 meters from the object that you will be measuring.
3. Hold the tracker like a pistol and look through the sighting tube to locate the highest point of the object.
4. While the object is still in your sight, hold the string in the position that it naturally falls because of the weight.
5. Record the angle on the chart below.
6. Use conversion chart to convert the angle into height in meters and record the height on the chart below.
7. Try this process with at least five other objects or until you feel that you have mastered the art of measuring the altitude of stationary objects.

8. Challenge: Stationary objects are easy; just wait until you try to track a rocket moving at 65 miles per hour! Now, have someone toss a tennis ball into the air and see if you can follow the path of the tennis ball through the sighting tube. Remember, the person with the tracker should be 10 meters away from the person throwing the ball. When the tennis ball reaches its highest point (apex), capture the angle by holding the string in the position that it naturally falls because of the weight. Do this several times until you become proficient at tracking the ball. Record the angle and height on the chart below.

9. Write a summary describing the process of finding the height of an object using an altitude tracker.

Object	Angle (degrees)	Height (meters)

Angle to Height Conversion Chart

Angle (at 10 meters)	Height	Angle (at 10 meters)	Height
0	0.0	45	10.0
1	.2	46	10.3
2	.4	47	10.7
3	.5	48	11.1
4	.7	49	11.5
5	.9	50	11.9
6	1.0	51	12.3
7	1.2	52	12.7
8	1.4	53	13.2
9	1.6	54	13.8
10	1.8	55	14.3
11	1.9	56	14.8
12	2.1	57	15.4
13	2.3	58	16.0
14	2.5	59	16.6
15	2.7	60	17.3
16	2.9	61	18.0
17	3.0	62	18.8
18	3.2	63	19.6
19	3.4	64	20.5
20	3.6	65	21.4
21	3.8	66	22.4
22	4.0	67	23.5
23	4.2	68	24.7
24	4.5	69	26.0
25	4.7	70	27.4
26	4.9	71	29.0
27	5.1	72	30.8
28	5.3	73	32.7
29	5.5	74	34.9
30	5.8	75	37.3
31	6.0	76	40.1
32	6.2	77	43.3
33	6.5	78	47.0
34	6.7	79	51.4
35	7.0	80	56.7
36	7.2	81	63.1
37	7.5	82	71.1
38	7.8	83	81.4
39	8.1	84	95.1
40	8.4	85	114.0
41	8.7	86	143.0
42	9.0	87	191.0
43	9.3	88	286.0
44	9.6	89	573.0