

RECORD BOOK

4-H MODEL

ROCKETRY



Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Elbert C. Dickey, Dean and Director of Cooperative Extension, University of Nebraska, Institute of Agriculture and Natural Resources.

The 4-H Youth Development program abides with the non-discrimination policies of the University of Nebraska-Lincoln and the United States Department of Agriculture.



REQUIREMENTS FOR MANUAL COMPLETION

1. Complete Rocket Record Book.
2. Build and successfully launch and recover a single stage rocket.

STATE FAIR EXHIBIT REQUIREMENT

Please check the current County or State Fair Premium List.

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MODEL ROCKET SAFETY CODE

I subscribe to the Model Rocket Safety Code:

1. My model rockets will be made of only lightweight materials such as paper, wood and plastic with the exception of payloads, and engine holders which can be made of metal material.
2. I will use only pre-loaded factory-made model rocket engines in the manner recommended by the manufacturer. I will not change in any way nor attempt to reload these engines.
3. I will always use a recovery system in my model rockets that will return them safely to the ground so they may be flown again.
4. My model rocket will weigh no more than 453 grams (16 oz.) at liftoff, and the engines will contain no more than 113 grams (4 oz.) of propellant.
5. I will check the stability of my model rockets before their first flight except when launching models of already proven stability.
6. The system I use to launch my rockets will be electrically operated and will contain a switch that will return to "off" when released. I will remain at least 10 feet away from any rocket that is being launched.

7. I will not let anyone approach a model rocket on a launcher until I have made sure that either the safety interlock key has been removed or the battery has been disconnected from my launcher.
8. I will not launch my model rocket in high winds, near buildings, power lines, tall trees, low-flying aircraft or under any conditions which might be dangerous to people or property.
9. My model rockets will always be launched from a cleared area, free of any easy-to-burn materials, and I will only use non-flammable recovery wadding in my rockets.
10. My launcher will have a blast deflector device to prevent the engine exhaust from hitting the ground directly.
11. To prevent accidental eye injury I will always place the launcher so the end of the rod is above eye level or cap the end of the rod with my hand when approaching it. I will never place my head or body over the launching rod. When my launcher is not in use I will always store it so that the launch rod is NOT in an upright position.
12. I will never attempt to recover my rocket from a power line or other dangerous places.
13. I will not launch rockets so their flight path will carry them against targets on the ground, and will never use an explosive warhead nor a payload that is intended to be flammable. My launching device will always be pointed within 30 degrees of vertical.
14. When conducting research activities with unproven designs or methods, I will, when possible, determine their reliability through pre-launch tests. I will conduct launchings of unproven designs in complete isolation from persons not participating in the actual launching.

Signed

LESSON 1

THE MODEL ROCKET

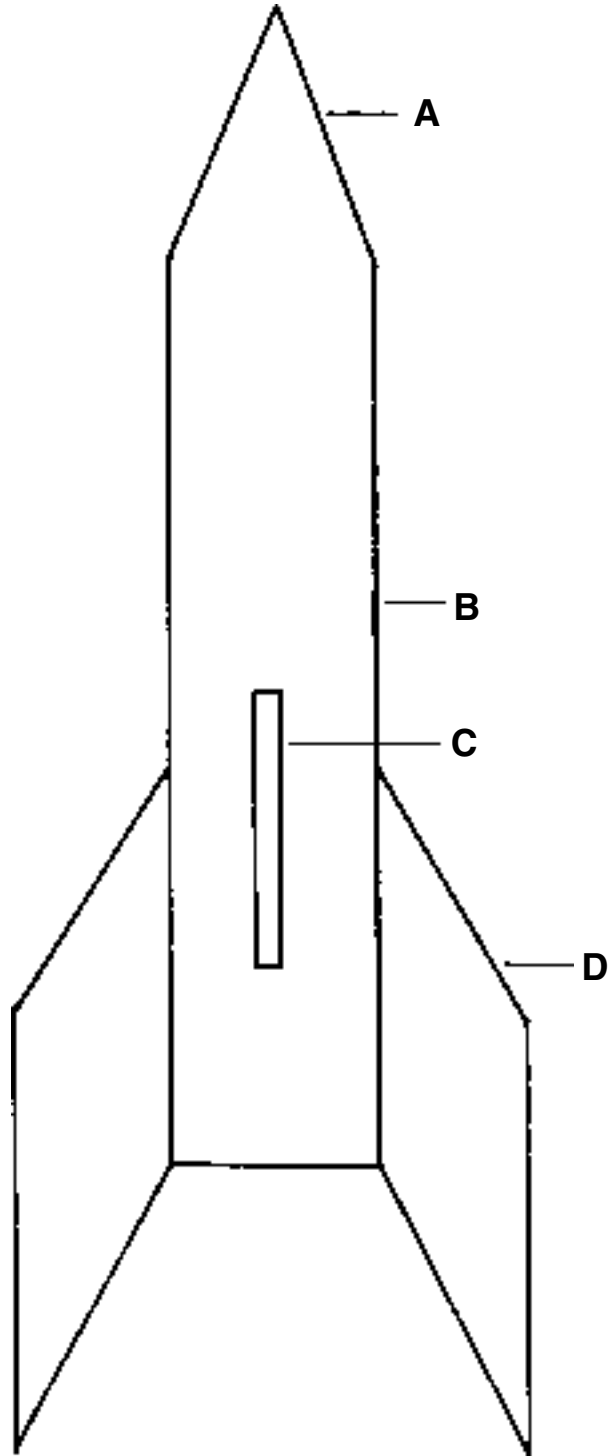
Name the parts on the model and tell what the purpose of each part is.

A. _____

B. _____

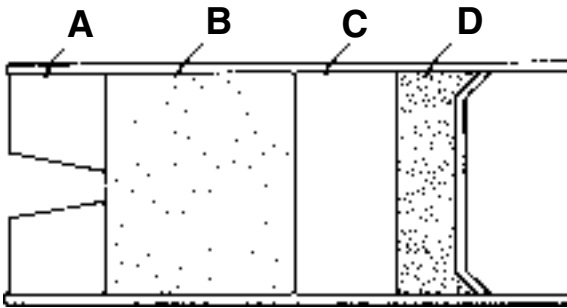
C. _____

D. _____



LESSON 2

THE ROCKET ENGINE



Label the Parts:

- A. _____
- B. _____
- C. _____
- D. _____

1. The rocket engine above is either a _____ stage or an _____ stage engine.
2. What parts are not needed in the above engine to make a booster engine?
_____, _____.
3. _____ propellant is used in the engines.
4. A rocket engine with **red** markings is a _____ engine.
5. A rocket engine with **green** markings is a _____ engine.
6. Tell what each number or letter stands for: 1/2 A 6 - 2 (This information will be packaged with your rocket engine.)

7. Explain what happens when the engine is ignited.

LESSON 3

ROCKET STABILITY

How do we find the following:

Center of gravity: _____

How would an unstable rocket fly if launched?

Describe two ways of determining whether a rocket is stable or not.

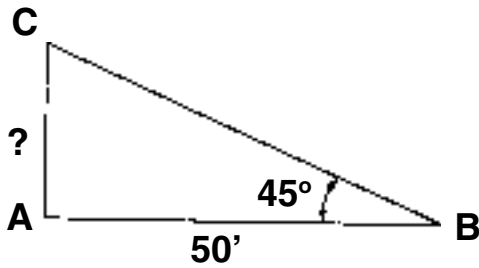
If your rocket is not stable how can you correct it?

LESSON 4

ROCKET STABILITY

The altitude your rocket goes can be calculated through a simple bit of mathematics.

In the figure below, line AC is the rocket altitude.
 line AB is distance from observer to launch pad.
 line BC is "eye-line" from observer to rocket.



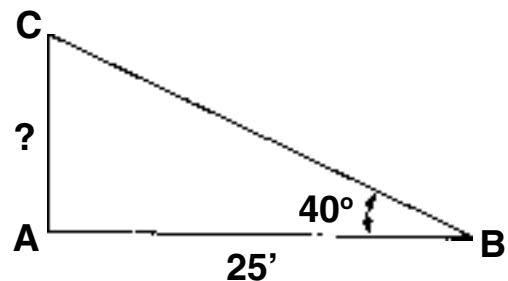
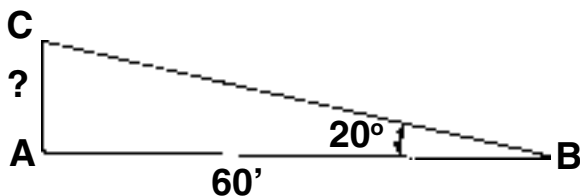
Angle indicated is know as the TANGENT angle. In the chart below find this angle on the chart and the tangent number in next column.

Angle	Tangent	Angle	Tangent	Angle	Tangent	Angle	Tangent	Angle	Tangent
1°	.02	19°	.34	37°	.75	55°	1.43	73°	3.27
2°	.03	20°	.36	38°	.78	56°	1.48	74°	3.49
3°	.05	21°	.38	39°	.81	57°	1.54	75°	3.73
4°	.07	22°	.40	40°	.84	58°	1.60	76°	4.01
5°	.09	23°	.42	41°	.87	59°	1.66	77°	4.33
6°	.10	24°	.44	42°	.90	60°	1.73	78°	4.70
7°	.12	25°	.47	43°	.94	61°	1.80	79°	5.14
8°	.14	26°	.49	44°	.96	62°	1.88	80°	5.67
9°	.16	27°	.51	45°	1.00	63°	1.96	81°	6.31
10°	.18	28°	.53	46°	1.03	64°	2.05	82°	7.12
11°	.19	29°	.55	47°	1.07	65°	2.14	83°	8.14
12°	.21	30°	.58	48°	1.11	66°	2.25	84°	9.51
13°	.23	31°	.60	49°	1.15	67°	2.36	85°	11.43
14°	.25	32°	.62	50°	1.19	68°	2.48	86°	14.36
15°	.27	33°	.65	51°	1.23	69°	2.61	87°	19.08
16°	.29	34°	.67	52°	1.28	70°	2.75	88°	28.64
17°	.31	35°	.70	53°	1.33	71°	2.90	89°	57.29
18°	.32	36°	.73	54°	1.38	72°	3.08		

MULTIPLY TANGENT NUMBER BY LENGTH OF LINE AB TO GET ALTITUDE OF ROCKET.

(height = (50) times (1) to get 50 feet altitude.)

TRY A COUPLE OF EXAMPLES:



LESSON 6

ROCKET COUNTDOWN PROCEDURES

This is a check list which should be followed at your launch. Be sure each item is checked as it is accomplished.

Check When OK

- _____ 1. Clear launch area of any obstructions above and within a 10-foot radius of the launcher.
- _____ 2. Solidly mount launcher platform.
- _____ 3. Place rocket(s) on launcher.
- _____ 4. Check power supply for voltage. TURN UNIT OFF.
- _____ 5. Connect power supply clips to igniter on rocket engine.
- _____ 6. Caution spectators to remain at least 10 feet away from rocket.
- _____ 7. Begin operation of any tracking instruments used.
- _____ 8. Begin countdown in a loud and clear voice.
- _____ 9. Ignite rocket.

IF MALFUNCTION OCCURS:

- 1. Turn power supply off.
- 2. Check **carefully** to see if rocket engine is "hot" or smoking before approachment.
- 3. Carefully approach rocket (only 1-2 persons).
- 4. Remove igniter wires. (Never stand "over" rocket at this point.)
- 5. Carefully remove rocket from launcher.
- 6. Check wires on igniter and engine. (Insert new engine if needed.)
- 7. When ready re-start the countdown procedures listed above.

RECORD OF CLUB ACTIVITIES

1. How many meetings did your club have this year? _____
2. How many meetings did you attend? _____
3. How many field trips did you take? _____
4. What offices did you hold in your club? _____
5. On what committees did you serve? _____
6. Did you demonstrate any of the lessons, if so what? _____

Where did you give your demonstration? _____

7. Total cost of Rocket Project:

Total Cost of Rockets	\$ _____
Rocket Engines	_____
Construction and Repair	_____
Miscellaneous Expense	_____
TOTAL PROJECT COST	\$ _____

Adapted with permission from the University of Idaho, Cooperative Extension Service. Appreciation is extended to developer Ned Pierson, 4-H leader, Jefferson County, Idaho.