MODEL ROCKET DIRECTIONS AND GRADING RUBRIC

Name: _____ Period: _____

Safety (0-18 points)

_____ Student works and acts in a safe manner at all times, following all instructions and wearing appropriate safety gear when necessary. This includes during assembly as well as when the rockets are being launched.

Rocket Completion: (0-35 pts)

_____ Rocket Body (5pts) –Body tube is straight, symmetrical, and is held together well

_____ Fins (5pts) – Fins are attached straight and spaced evenly around the body.

_____ Parachute/streamer (5pts)- The rocket must have a recovery method that is securely attached to the body of the rocket.

_____ Nosecone (5pts) – Nosecone is aerodynamic, fits well with the body of the rocket, and is attached to the body tube in some way.

_____ Engine Mount (5pts) – Engine mount is the proper size, lays flat against the body of the rocket, and will prevent an engine from falling out.

_____ Launch Lug (5 pts) – Straw segment is firmly attached and aligned well

_____ Design and appearance (5 pts) - rocket has student name on it and is nicely decorated

Written Assignments (32 pts)

_____ Rocket calculations (20pts) (Separate worksheet)

_____ Written Evaluation (12 pts)

Participation (15 pts)

_____ Student was on task at all times, worked efficiently, and followed directions well.

Total: _____ /100 pts

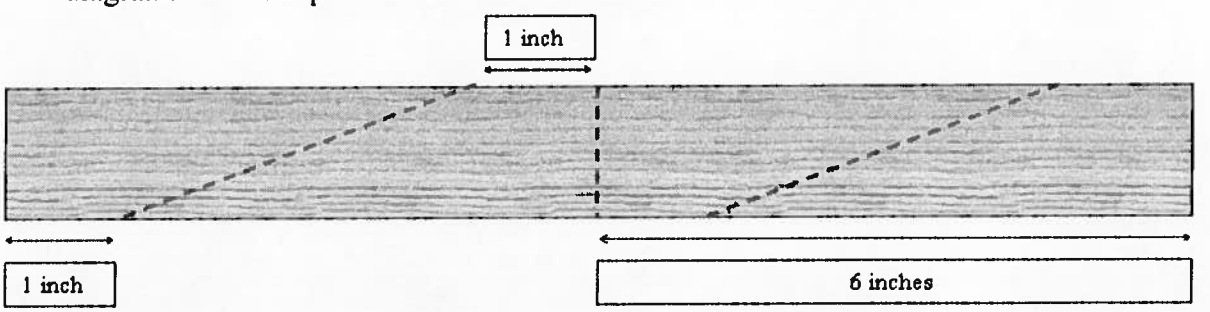
Model Rocket Building Instructions

Body:

1. Obtain a ½" piece of metal conduit to use as the body tube form out of the bin
2. Obtain a 3" wide precut strip of computer paper.
3. Tightly wrap the piece of computer paper lengthwise around the metal form. Attach at each end and in the middle using scotch tape.
4. Cut an 11" and 18" piece of gummed tape. You can choose the color of your choice. You should select the same color for both pieces.
5. Using a damp sponge, wet the backside of the 11" long piece of gummed tape. It will become very sticky so be careful not to stick it to anything.
6. Wrap the 11" piece of gummed tape lengthwise around the metal form (wrap it right over the top of the computer paper). There should be no wrinkles in the paper.
7. With the 18" long strip of gummed tape, fold one corner over to form a triangle, ultimately making a 45 degree angle.
8. Cut off this corner triangle using scissors
9. Using a damp sponge, wet the backside of the 18" strip of gummed tape. Again, making sure it does not stick to anything you don't want it to.
10. Align the end of the metal form to the pointed end of the triangle where you made the previous cut.
11. Begin rolling the body tube, creating a spiral effect around the metal form. (This is the most difficult part of the body tube)

Fins:

1. Obtain a strip of balsa wood, which is 1.5 inches wide by 12 inches long.
2. Measure carefully, and then re-measure! Using an x-acto knife, cut according to the diagram. This will produce four identical fins.



3. Glue each fin's diagonal edge to the rocket body with a hot glue gun. It is important that they are straight and evenly spaced around the body tube. The rocket will fly with either three or four fins. Use glue sparingly.

Nose Cone

1. Obtain a pre-cut piece of foam.
2. Slowly sand the foam to crate a pointed nose cone. This nose cone wants to be extremely symmetrical and straight. The diameter that fits into the body tube of the rocket should be slightly smaller than the portion that is exposed. (See teacher example)
3. Cut a piece of nylon string 25 – 30 cm long. Glue one end to the flat part of the nose cone and the other end to the inside of the rocket body, a few cm from the top. Make sure your foam nose cone still slides in easily!

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Recovery System:

We will use plastic bags to bring our rockets back to earth slowly (hopefully). There are two methods:

Streamer Method:

If you are short on time, this method is for you. Streamers are also more reliable, but don't create quite as much air resistance as parachutes.

1. Cut out one long strip of plastic about 6 cm wide but 30 – 40 cm long.
2. Poke a hole in one end, and tie a 20 cm piece of string to it.
3. Attach the free end of the string to the inside of the nose cone tube.

Parachute Method:

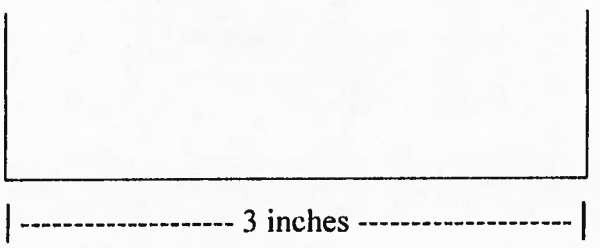
These create lots of air resistance for a gentle landing but take longer to make and don't always eject correctly.

1. Cut out a square (no more than 15 cm on each side) from a plastic bag
2. Poke a hole near each of the four corners.
3. Cut four pieces of string, which are 20 cm each. Tie a separate string to each corner.
4. Tape the ends of the four strings together.
5. Attach the taped portion to the inside of the nosecone tube.

Engine Mount

Since the rocket engine creates a great deal of thrust (upward force), we need a way to hold the engine in place so it doesn't shoot through the nose cone or fall out the bottom.

1. Cut a 5" long piece of metal wire.
2. Bend it as shown in the diagram below. Try to create 90° angles at the corners.
3. Drill two small holes in the body of the rocket. One should be about 3mm from the bottom, the other three inches above the first (or the length of your bent wire if you measured correctly).
4. Insert the wire (engine mount) into holes, but don't glue.



Launch Lug

1. Glue a 3"-4" piece of straw to the body tube in between two of the fins near the engine mount. ***Note, make sure the launch lug is NOT in line with a fin or the launch rod cannot go through the launch lug.
2. The pole of the launch pad will be slid through this straw when we are ready to launch.

Decorate your Rocket

1. Style counts! You've worked hard on your rocket. Now make it distinctively yours!

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Rocket Calculations

Any questions which do not show work and give units will be counted wrong.

1. Record the mass of your rocket (give units!): _____

2. The mass of the engine is 20.1g. Add this mass to your mass from above: _____

3. Convert the mass from #2 into kilograms (otherwise we can't use it in our equations!):

Rocket Mass = _____ kg (1000 grams in a kg)

This is the total mass of the rocket at takeoff. Use this mass for the rest of the calculations!

4. Write out Newton's 2nd Law, then use it to calculate the force of gravity on your rocket. Hint: you will need to know how fast Earth's gravity accelerates all objects (this number is 32 ft/s^2 or 9.8m/s^2). **Show work and include units.**

Written Evaluation:

Complete on a separate sheet of paper and use complete sentences for each.

1. Explain what Newton's third law has to do with launching rockets. Identify the action and reaction forces.

2. Identify all of the following that could affect the amount of **air resistance** (friction) on the rocket: Size of nose cone, mass of rocket, color, speed, number of fins. Include a short explanation why the factors you chose could affect the air resistance.

3. Write a paragraph evaluating your rocket. Do you think it is well constructed? Describe the best part of your rocket. What are the problem areas of your rocket that might keep it from flying well? What would you do differently if you were to build a second rocket?

4. Rate your effort in completing this project. Out of 20 points, what should your safety score be? What should your participation grade be out of 15 possible points? Explain why. Did you find the project to be challenging or easy?