MODEL ROCKETRY

PATHFINDER

E-HONOUR
ADVENTURER CLUB
PATHFINDER
2020

A

B

C

D

GUESS THE NAME OF THE ROCKETS

A

B

C

D

GUESS THE NAME OF THE ROCKETS

HONOUR REQUIREMENTS

1. Know and explain the Model Rocketry Safety Code.

2. Know and explain the importance of the basic model rocket components

3. Draw the following:
   a. The steps in the flight of a model rocket
   b. A cut-a-way view of a model rocket engine, labeling each part
   c. A schematic plan for a simple launch system using proper electrical symbols

4. Define the following:

a. Wadding	b. Boost gliders	c. Stall
d. Payload	e. Apogee	f. Center of gravity
g. Center of pressure	h. Impulse	i. Velocity
j. Ejection		

5. Name and describe at least four different recovery systems.

6. From a kit, build, finish, and paint a single-stage rocket that has a minimum length of six inches with a recovery system, such as a parachute or streamer. Successfully launch and recover the rocket with the recovery system deploying properly.

1. SAFETY CODE

a. Materials

I will use only lightweight, non-metal parts for the nose, body, and fins of my rocket.

1. SAFETY CODE

b. Motors

I will use only certified, commercially-made model rocket motors,

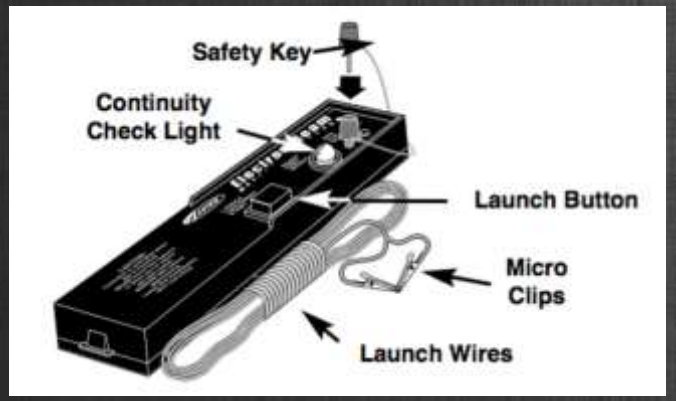
and will not tamper with these motors or use them for any purposes except those recommended by the manufacturer.

1. SAFETY CODE

c. Ignition system

I will launch my rockets with an electrical launch system and electrical motor igniters.

My launch system will have a safety interlock in series with the launch switch, and will use a launch switch that returns to the "off" position when released.



1. SAFETY CODE

d. Misfires

If my rocket does not launch when I press the button of my electrical launch system

I will remove the launcher's safety interlock or disconnect its battery

and will wait 60 seconds after the last launch attempt before allowing anyone to approach the rocket.

1. SAFETY CODE

e. Launch Safety

I will use a countdown before launch, and will ensure that everyone is paying attention and is a safe distance of at least 15 feet away when I launch rockets with D motors or smaller, and 30 feet when I launch larger rockets

If I am uncertain about the safety or stability of an untested rocket, I will check the stability before flight and will fly it only after warning spectators and clearing them away to a safe distance.

1. SAFETY CODE

f. Launcher

I will launch my rocket from a launch rod, tower, or rail that is pointed to within 30 degrees of the vertical to ensure that the rocket flies nearly straight up

I will use a blast deflector to prevent the motor's exhaust from hitting the ground.

1. SAFETY CODE

g. Size

My model rocket will not weigh more than 1.5kg at lift off and will not contain more than 125 grams of propellant or 320 N-sec of total impulse

Any model heavier or requires more lift off impulse, you will need to refer back to the country laws and rules of aviation.

1. SAFETY CODE

h. Flight safety

I will not launch my rocket at targets, into clouds, or near airplanes, and will not put any flammable or explosive payload in my rocket.

1. SAFETY CODE

i. Launch site

I will launch my rocket outdoors

in an open area at least as large as shown in the accompanying table

in safe weather conditions with wind speeds no greater than 20 miles per hour.

I will ensure that there is no dry grass close to the launch pad, and that the launch site does not present risk of grass fires.

LAUNCH SITE DIMENSIONS

Installed Total Impulse (N-sec)	Equivalent Motor Type	Minimum Site Dimensions (ft.)
0.00–1.25	1/4A, 1/2A	50
1.26–2.50	A	100
2.51–5.00	B	200
5.01–10.00	C	400
10.01–20.00	D	500
20.01–40.00	E	1,000
40.01–80.00	F	1,000
80.01–160.00	G	1,000
160.01–320.00	Two Gs	1,500

1. SAFETY CODE

j. Recovery System

I will use a recovery system such as a streamer or parachute in my rocket so that it returns safely and undamaged and can be flown again

I will use only flame-resistant or fireproof recovery system wadding in my rocket.

1. SAFETY CODE

k. Recovery Safety

I will not attempt to recover my rocket from

power lines

tall trees

or other dangerous place

2. Know and explain the importance of the basic model rocket components

The **launch lugs** are small tubes (straws) which are attached to the body tube.

Parachutes and streamers are made of thin sheets of plastic.

Removable Solid Rocket engine: Model rockets use small, pre-packaged, solid fuel engines.

Parachute lines to connect the parachute to the nose cone.

The fins can be made of either plastic or balsa wood and are used to provide stability during flight.

Body tube of the rocket is a green cardboard tube with black **fins** attached at the rear

The nose cone can be made of balsa wood, or plastic, and may be either solid or hollow.

An elastic **shock cord** is connected to both the body tube and the nose cone and is used to keep all the parts of the rocket together during recovery

Recovery wadding is inserted between the engine mount and the recovery system to prevent the hot gas of the ejection charge from damaging the recovery system.

The engine mount. This part is fixed to the rocket and can be made of heavy cardboard or wood. There is a hole through the engine mount to allow the ejection charge

3. Draw the following:

a. Steps in the flight of a model rocket

Launch begins as soon as the motor ignites and ends when the rocket clears the launch rail.

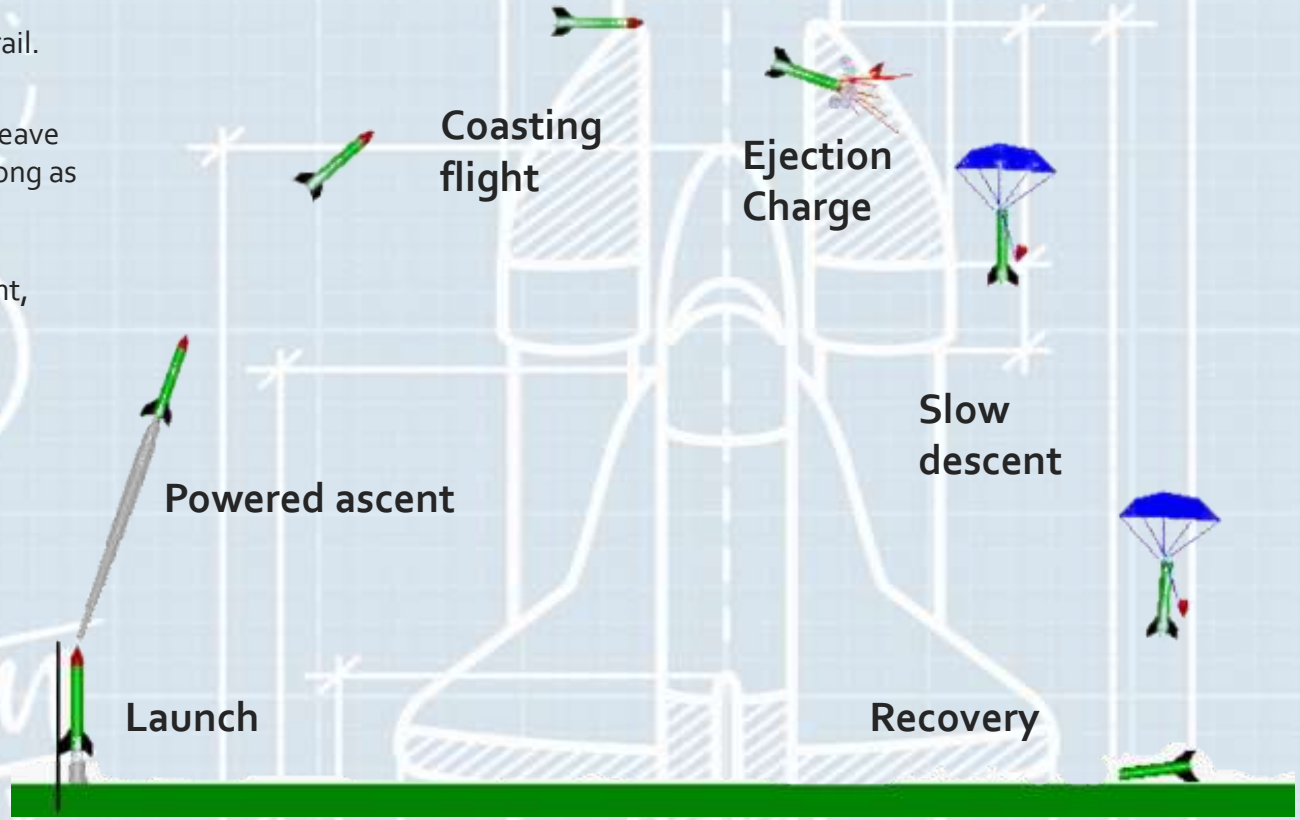
Powered ascent: After the motor ignites, it generates thrust which causes the rocket to leave the launch pad and ascend into the air. The engine will continue to provide thrust for as long as it burns, and it will continue to power the rocket into the sky.

Coasting flight: The motor will burn for a fixed amount of time and then stop. At this point, there is a delay and the rocket continues to glide upwards, riding the momentum gained during the thrust phase. As the engine burns through the delay charge, it leaves a trail of smoke as a visual aid to the rocketeer.

Ejection Charge: At the end of the delay, the motor ignites an ejection charge which blows the nose cone off the rocket and deploys the recovery system.

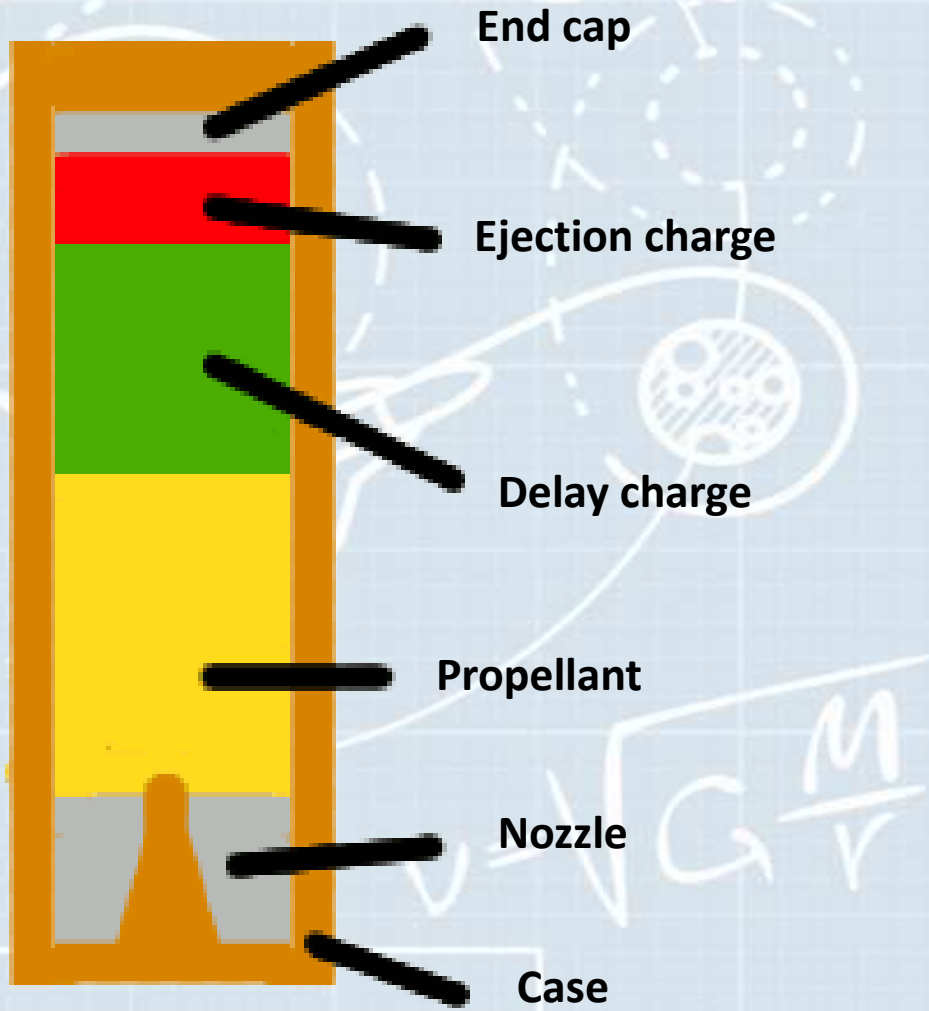
Slow descent: The rocket returns to the ground using one of the recovery techniques listed below.

Recovery: When the rocket reaches the ground, it can usually be recovered by its owner.



3. Draw the following:

a. A cut-a-way view of a model rocket engine, labeling each part



3. Draw the following:

c. A schematic plan for a simple launch system using proper electrical symbols

4. Define the following:

a. Wadding

Wadding is a fire-proof paper-like substance that is wadded up and place inside the body tube between the engine and the recovery system. Its purpose is to prevent the hot gases released by the engine from damaging the recovery system and payload. Wadding is sold as a package included with the engine.

b. Boost gliders

A boost glider is a model which is launched into the air via rocket power, and then all or part of it glides gently back to the earth using aerodynamic control surfaces. During the powered ascent, the glider portion acts as a stable, ballistic body attached to the rocket. It then transitions to a glider during the coasting flight phase. This transition presents the most challenging aspect of a boost glider design.

c. Stall

In aerodynamics, a stall is a sudden reduction in the lift forces generated by an airfoil. This most usually occurs when the critical angle of attack for the airfoil is exceeded.

d. Payload

The payload of a rocket is held in the nose cone. In model rocketry, there may or may not be a payload at all.

e. Apogee

A rocket's apogee is the highest point in its flight path.

4. Define the following:

f. Center of gravity

All matter, regardless of size, mass, or shape, has a point inside called the center of gravity, or more commonly, **the center of mass (CM).** The center of mass is the exact spot where all of the mass of that object is perfectly balanced.

The center of mass is important in rocket flight because it is around this point that an unstable rocket tumbles

g. Center of pressure

In addition to center of mass, there is another important center inside the rocket that affects its flight. This is the center of pressure (CP). The center of pressure exists only when air is flowing past the moving rocket. This flowing air, rubbing and pushing against the outer surface of the rocket

It is extremely important that the center of pressure in a rocket be located toward the tail and the center of mass be located toward the nose. If they are in the same place or very near each other, then the rocket will be unstable in flight.

4. Define the following:

h. Impulse

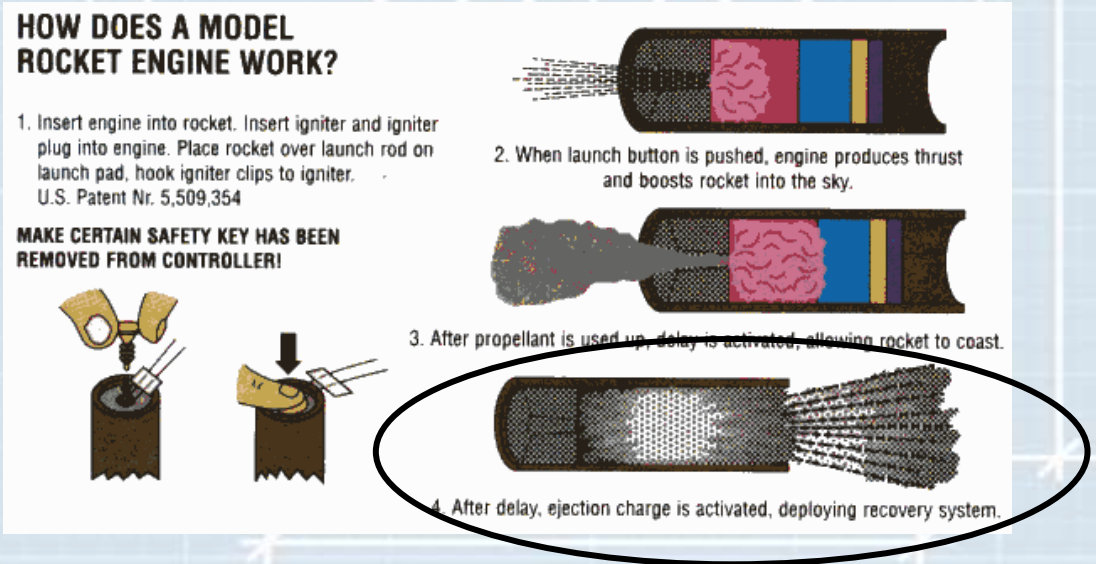
An impulse may be regarded as the change in momentum of an object to which a force is applied.

i. Velocity

Velocity is a measurement of both speed and direction. If either speed or direction changes, the velocity changes.

j. Ejection

Ejection occurs at the end of the coasting phase of a model rocket's flight when the engine ignites the ejection charge. This charge blows the nose cone off and deploys a parachute or a streamer.



5. Name and describe at least four different recovery systems

Nose Blow recovery

A very simple recovery technique, used in very early models in the 1950s and occasionally in modern examples, is nose-blow recovery. This is where the ejection charge of the motor ejects the nose cone of the rocket (usually attached by a shock cord made of rubber, Kevlar string or another type of cord) from the body tube. Nose-blow recovery is generally only suitable for very light rockets.

Tumble recovery

The simplest approach, and one only appropriate for small rockets or rockets with a large cross-sectional area, is to have the rocket tumble back to earth. Any rocket which will enter a stable, ballistic trajectory as it falls is not safe to use with tumble recovery.

Parachute/Streamer

The approach used most often in small model rockets. It uses the ejection charge of the motor to deploy, or push out, the parachute or streamer. Air resistance slows the rocket's fall, ending (hopefully) in a smooth, controlled and gentle landing.

Glide recovery

In glide recovery, the ejection charge either deploys an airfoil (wing) or separates a glider from the motor. If properly trimmed, the rocket/glider will enter a spiral glide and return safely

Helicopter recovery

The ejection charge, through one of several methods, deploys helicopter-style blades and the rocket auto-rotates back to earth.

6. From a kit, build, finish, and paint a single-stage rocket that has a minimum length of six inches with a recovery system, such as a parachute or streamer. Successfully launch and recover the rocket with the recovery system deploying properly.

If instead of buying a kit, you wish to build the rocket from scratch using day to day household materials, please find below some video links which would help you.

Part 1

https://www.youtube.com/watch?v=ZapThi1Hafo&t=

Part 2

https://www.youtube.com/watch?v=HMQN0EjSNcM

Parachute Recovery systems

https://www.youtube.com/watch?v=yYm1_nedVu0

https://www.youtube.com/watch?v=H-SNqZcMnX8

PS: Any model rocket launch have to be under adult supervisory and to follow the safety guidelines.

We would like you to send us a picture of your build model rocket to Dejan using his email address: dejan@adventist.uk

KAHOOT QUIZ CHALLENGE

Do you think you can take on the challenge?!?!

Click on the link below and answer 28 questions and check with your pathfinder friends their scores.

https://kahoot.it/challenge/08840041?challenge-id=58ed943d-88bb-464e-b386-4b5eece80837_1590750186798

Game pin number is: 08840041

The challenge will end on the 14th of June 2020 at 20h00.

Good Luck and have fun.

SUMMARY

1. Know and explain the Model Rocketry Safety Code.

2. Know and explain the importance of the basic model rocket components

3. Draw the following:
   a. The steps in the flight of a model rocket
   b. A cut-a-way view of a model rocket engine, labeling each part
   c. A schematic plan for a simple launch system using proper electrical symbols

4. Define the following:

a. Wadding	b. Boost gliders	c. Stall
d. Payload	e. Apogee	f. Center of gravity
g. Center of pressure	h. Impulse	i. Velocity
j. Ejection		

5. Name and describe at least four different recovery systems.

6. From a kit, build, finish, and paint a single-stage rocket that has a minimum length of six inches with a recovery system, such as a parachute or streamer. Successfully launch and recover the rocket with the recovery system deploying properly.


Thank you