Tripoli Mentoring Program Training Study Guide

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The Training portion of the Tripoli Mentoring Program trains Juniors in safe rocket construction and safe range practices. Successful completion of the training grants the Junior flyer access to restricted high-power areas.

TMP Training is a self-study program that can be done either by the Junior alone or, preferably, under the guidance and advice of a Mentor. The training culminates in the taking of the TMP Training Exam. The exam is 30 questions long, with 15 Technical questions and 15 Safety questions. The Technical questions cover knowledge of safe rocket construction and launching. The Safety questions cover range safety knowledge. A passing grade is 83% correct, meaning that a test taker can miss no more than 5 questions to receive a pass.

The TMP Training Exam can be administered by Prefects, TAPS, and TRA Directors, and can be taken at the launch site or any other location that is convenient for the person taking the test and the person administering the test. The Junior flyer may join Tripoli, take the TMP Training exam and fly under the TMP all on the same day. The TMP Training Exam has two versions. If the Junior fails one version, the Junior may immediately take the other version. If the Junior fails both versions, the Junior cannot take the exam again for a minimum of 7 days.

Before completing the training, the Junior member must obtain consent from their parent or legal guardian to participate in high power rocketry activities. The consent statement is on the TMP Training Exam answer form, and must be signed before taking the Exam.

After completing TMP Training, the Exam Administrator sends an electronic facsimile of the **Universal Certification Form** showing that the test has been passed to Tripoli headquarters. The Junior will receive a new membership card that reflects the completion of TMP Training.

In addition to this Study Guide, the following reading materials are helpful in preparing for the exam and learning about rocketry.

1. Tripoli Unified Safety Code, Version 1.2 or later, https://www.tripoli.org/safety

Part 1 - Technical Questions

1) Which forces are present during a rocket's ascent and will negatively affect the altitude that the rocket achieves?

A. Inertia and drag.
B. Gravity and drag.
C. Thrust and momentum.

2) Which forces are present during a rocket's ascent and will increase the altitude that the rocket achieves?

A. Thrust and momentum.
B. Thrust and inertia.
C. Gravity and drag.

3) How does Newton's Third Law "To every action there is always an equal and opposite reaction" relate to how a rocket ascends under the power of its motor?

A. The heat produced by the combustion of the propellant lifts the rocket.
B. The flame from the burning propellant produces aerodynamic lift which lifts the rocket.
C. Pressurized gasses produced by the combustion of the propellant cause the rocket to accelerate in the opposite direction of the expelled gasses.

4) Two rockets are identical, except in weight: one weighs 2 pounds, and one weighs 3 pounds. Both are launched in the same conditions on the same type of motor. Which outcome would you expect to occur?

A. The 2-pound rocket achieves a higher altitude.
B. The 3-pound rocket achieves a higher altitude.
C. Both rockets achieve the same altitude.

5) Two identical rockets are travelling at different speeds. Which rocket experiences greater aerodynamic drag force?

A. The rocket that is moving slower.
B. The rocket that is moving faster.
C. Both experience the same aerodynamic drag force.

6) To reduce the effect of drag on a rocket:

A. Round the leading edges of the rocket's fins.
B. Add a boat tail to the aft end of the rocket.
C. Both A and B.

7) The Center of Pressure (CP) of a rocket is generally defined as:

A. The balance point of the rocket without the motor.
B. The point at which aerodynamic lift on a rocket is centered.
C. The total area of the fins, airframe and nose cone divided by two.

8) The Center of Gravity (or Center of Mass) is the point at which:

A. The rocket is the heaviest.
B. Aerodynamic lift is centered.
C. There is an equal amount of mass aft of the point and forward of the point.

9) For an inherently stable rocket, which statement about the center of gravity (CG) and the center of pressure (CP) is true?

A. The CG must be forward of the CP relative to the desired direction of flight.
B. The CG must be behind the CP relative to the desired direction of flight.
C. The CG must move forward (in the desired direction of flight) during the motor burn.

10) What is the recommend "rule of thumb" relationship between Center of Gravity (CG) and Center of Pressure (CP) for a stable rocket?

A. The center of gravity should be very nearly at the same point as the center of pressure.
B. The rocket should balance near or at the center of gravity.
C. The center of gravity should be at least one caliber in front of the center of pressure.

11) A 2" diameter rocket, loaded with its motor, has a Center of Gravity (CG) two inches behind the Center of Pressure (CP). Is this rocket likely to be stable?

A. No, the CG should be at least two body tube diameters behind the CP.
B. No, the CP must be behind the CG for the rocket to be stable.
C. Yes, the CP is one body diameter in front of the CG.

12) If you wanted to move the CP to improve stability, you would do so by:

A. Adding nose weight.
B. Increasing fin size.
C. Decreasing fin size.

13) When the CG is aft of the CP, the rocket will:

A. Cock into the wind after lift-off.
B. Lose one or more of its fins ("shred") before assuming an erratic flight path.
C. Tumble end over end, or otherwise assume an erratic flight path.

14) You can increase the stability margin of a rocket by:

A. Adding weight to the nose cone.
B. Making the fins smaller.
C. Using a larger amount of epoxy on the fin can so that the fins will be more firmly attached.

15) A 2" diameter rocket, loaded with its motor, has a Center of Gravity (CG) ten inches forward of the Center of Pressure (CP). Which is most likely to occur?

A. The rocket may "skywrite". It is not stable.
B. The rocket may weather cock into the wind after lift-off.
C. The rocket may fly too slowly because it is too long.

16) What three things will improve the stability of a rocket?

A. Add nose weight, make the rocket longer, or increase the number of fins.
B. Add nose weight, make the rocket longer, or make the fins smaller.
C. Add nose weight, use a larger motor, or make the fins smaller.

17) If the burn time of a J200 motor is 4 seconds, what is the total impulse of the motor?

A. 50 Newton-seconds.
B. 800 Newton-seconds.
C. 800 Newtons.

18) Which of the motors listed below has the highest total impulse?

A. H100.
B. H200.
C. I100.

19) Which of the motors listed below has the highest average thrust?

A. H100.
B. H200.
C. I100.

20) What does the motor designation H180-8 mean?

A. The motor has between 160-320 Newton-seconds of total impulse, an average thrust of 180 Newtons, with 8 seconds between motor ignition and ejection.
B. The motor has 180 Newton-seconds of total impulse, an average thrust of 180 Newtons, with 8 seconds between motor burn-out and ejection.
C. The motor has between 160-320 Newton-seconds of total impulse, an average thrust of 180 Newtons, with 8 seconds between motor burn-out and ejection.

21) What is a Newton?

A. The amount of force required to accelerate one kilogram to a velocity of one meter per second in one second.
B. The amount of force required to accelerate one pound to a velocity of one foot per second in one second.
C. The amount of force required to accelerate one kilogram to a velocity of one foot per second in one second.

22) What is a good guideline for determining how much weight a rocket motor can safely lift?

A. Use a motor with at least as much average thrust, converted to pounds, as the fully loaded weight of the rocket, measured in pounds.
B. Use a motor with at least 5 times as much initial thrust, as the fully loaded weight of the rocket, being sure to use the same units for both.
C. Use a motor with at least 5 times as much peak thrust, measured in Newtons, as the fully loaded weight of the rocket, measured in pounds.

23) Which method of recovery is not considered an active recovery method and is NOT likely to be safe for a high-power rocket?

A. Single Parachute.
B. Dual deploy with drogue and main parachutes.
C. Tumble recovery.

24) Which shock cord material is common in model rockets, but not sufficiently strong enough to take the extra forces of deployment of larger, high-power rockets?

A. Kevlar.
B. Braided nylon.
C. Elastic.

25) Your simulation program recommended an 8 second ejection delay for your rocket and the motor you plan to use. The simulation program assumed no winds, but the winds at the launch site are 15 miles per hour. Which adjustment to the ejection charge delay is the best option?

A. Use a shorter ejection delay.
B. Keep the delay the same.
C. Use a longer ejection delay.

26) Which of the following can occur if your rocket's nose cone is seated loosely in the body tube?

A. The nose cone will separate easily when the ejection charge fires, and increase the chance of a successful launch.
B. The nose cone will separate when the rocket arcs over, so the recovery system is sure to deploy.
C. The rocket body may slow down from drag, allowing the nose cone to pull away from the rocket, leading to a drag separation and early deployment of the recovery system.

27) Your simulation program calculated that your rocket will achieve aerodynamic stability just before it leaves a 12-foot-tall launch rail. At the launch site, only 6-foot launch rails are available. You should:

A. Launch your rocket on the 6-foot rail. Your CG is forward of your CP by at least one body tube diameter, so the length of the rail does not matter.
B. Use a "faster" (higher initial thrust) motor so that the rocket achieves sufficient velocity for aerodynamic stability in a shorter distance.
C. Use the 6-foot rail, but angle the rail so that it has less effect on aerodynamic stability.

28) You want your rocket to achieve high speeds. To minimize drag from launch guides, you can safely:

A. Use a tower launcher that will guide the path of the rocket without any drag-inducing guides on the rocket.
B. Tape on the launch lugs so that they will fall off after the leave the launch rod.
C. Use only one rail button. Using one rail button will give less drag than using two rail buttons.

29) Which is the weakest fin attachment method and, although it is popular with model rockets, might not be strong enough for high power rockets?

A. Attach fins to the motor tube through fin slots in the body tube ("through the wall").
B. Attach fins directly to the body tube with wood glue.
C. Attach fins directly to the body tube, and then strengthen by epoxying layers of fiberglass cloth from fin tip to fin tip.

30) Which is a possible unsafe consequence of using fin material that is too thin or weak for your rocket and the motor that you are using?

A. The rocket will not gain the same altitude as it could have with stronger fins.
B. The fins might come off mid-flight and make the rocket unstable (a "shred").
C. The rocket will achieve higher altitude than it would have with heavier fin material.

Part 1 - Technical Question Answers

1. B. Gravity is always present, resisting vertical flight in the ascent phase. Drag, determined by the rocket's design and construction, presents aerodynamic resistance to vertical flight in the ascent phase.

2. A. Thrust is provided by the rocket motor in the powered part of the ascent phase; momentum is built up during the powered part of the ascent phase, and carries the rocket upward through the coast phase, being progressively reduced by gravity and drag until the rocket reaches apogee.

3. C. Newton's Third Law states that applying a force in one direction always results in an equal force in the opposite direction.

4. A. The 2-pound rocket will be expected to reach a higher altitude since the force of gravity, resisting vertical flight in the ascent phase, will be less than a 3-pound rocket.

5. B. All rockets have a drag coefficient (C_d) determined by design and construction. The C_d progressively increases with speed when traveling through air. Thus, for two identical rockets (having the same C_d), the one traveling at a higher speed will create more drag.

6. C. Rounded fin edges create less drag than square ones, and boat tails reduce "base drag" which is created to a greater degree by a squared-off aft end of a rocket.

7. B. The center of pressure (CP) is the point on the rocket where the aerodynamic lift is centered. This means that aerodynamic lift, if the rocket is at a non-zero angle of attack, forward of this point is balanced by the aerodynamic lift aft of that point.

8. C. Simply stated, the center of gravity (CG) is point at which a rocket will balance fore and aft if placed on top of an edge or suspended by a cord.

9. A. The center of pressure (CP) is where the aerodynamic lift, due to the rocket being at a non-zero angle of attack, is centered. For an aerodynamically stable rocket with the CP behind the center of gravity (CG), the lift which is centered aft of the CG will create a corrective moment to return the rocket to zero degrees angle of attack. Conversely, if the CP is ahead of the CG the lift will attempt to turn the rocket around so that the CP will again be behind the CG. This resultant "tumbling" is characteristic of an unstable rocket.

10. C. Keeping the center of gravity (CG) one caliber in front of the center of pressure (CP) typically allows an adequate margin for rocket stability.

11. B. A rocket that has the center of pressure (CP) ahead of the center of gravity (CG) will always be unstable, regardless of the distance between these two points.

12. B. Increasing fin size will move the CP aft, improving the stability margin. Decreasing fin size will decrease stability. Adding nose weight will improve stability, but will do so by moving the CG, not the CP.

13. C. A rocket that has the center of gravity (CG) behind the center of pressure (CP) will be unstable, and therefore may tumble or fly in an erratic pattern.

14. A. Adding weight to the nose cone will move the CG forward, which improves stability. Making the fins smaller will move the CP forward, which decreases stability. Using a larger amount of epoxy will add weight to the back end of the rocket, which will move the CG aft and decrease the stability margin.

15. B. The rocket has a stability margin of 5, and is over stable. All rockets can weather cock, but weather cocking is more likely to occur in over stable rockets.

16. A. Adding nose weight and making the rocket longer will move the CG forward and increasing the number of fins will move the CP aft.

17. B. By motor naming conventions a J200 motor has an average thrust of 200 Newtons. Multiply the average thrust (200 Newtons) by the burn time (4 seconds) to get the total impulse of 800 Newton-seconds.

18. C. The H motor has a range of 160 to 320 Newton-seconds and the I motor has a total impulse range of 321 to 640 Newton-seconds.

19. B Even though the total impulse of the I motor is greater than the H motor, the H motor's average thrust is 200 Newton's versus the I motor's 100 newtons.

20. C. This is an H motor with a total impulse range of 160.01 to 320 Newton-seconds, an average thrust of 180 Newtons and an ejection delay of 8 seconds from burn-out.

21. A. The newton is an international (metric) unit of force and is the force required to accelerate one kilogram (2.2 lbs.) to a velocity of one meter (39.4 inches) per second in one second.

22. B. A 5:1 thrust-to-weight ratio is a good minimum guideline to follow, but make sure you are working with the same units on both sides of the ratio! When it is windy, a greater than 5:1 thrust-to-weight ratio should be considered.

23. C. Generally, tumble recovery is only safe for small and/or very lightweight rockets, which would normally more likely be a model rocket. A rocket that is built sufficiently strongly and/or is of a sufficient size to structurally handle high power motors is unlikely to be light/small enough for safe tumble recovery.

24. C. Elastic shock cords, a common feature of model rockets, are less likely to handle the increased weight, size, and flight capabilities of high-power rockets.

25. A. The rocket will arc into the wind, achieving a lower apogee at an earlier time.

26. C. Drag separation occurs because the drag on the aft section of the rocket, where the fins are, is typically higher than the drag of the nose cone or forward section. If the nose cone is not tight enough such that the whole rocket can be lifted by holding the nose cone, the aft section might be pulled away from the nose cone. The heavier the nose cone, the more pronounced the problem, because the nose cone has more of its own momentum. Positive retention, such as shear pins, can be used to reduce the incidence of drag separation.

27. B. All rockets have a minimum distance that they must travel from lift-off to be aerodynamically stable, which is dependent on the rocket design and construction, plus the impulse characteristics of the motor used. If 12 ft. is required to achieve stable flight for any given rocket on a specific motor, this distance can be reduced for the same rocket if a higher average/initial impulse ("faster") motor is used.

28. A. Launch lugs and rail buttons will always add an amount of drag to a rocket. However, weakening their attachment or using fewer lugs/buttons is not a safe or effective way to address the drag they create. Launch lugs or rail buttons can be eliminated altogether if the rocket is flown from a launch tower correctly configured to provide effective vertical alignment of the rocket from lift-off to the distance the rocket requires to reach the minimum speed for stability.

29. B. Although this method is used frequently in low power rockets, it is typically weaker than the other methods. Fin attachment needs to be considered when building rockets for use with high power motors, which can have very high levels of thrust. Through the wall fins can be attached both to the motor tube and to the body tube, which strengthens the attachment. With minimum dimension rockets, modelers will attach the fins directly to the body tube, but will offset this by using stronger materials, stronger glue and, often, tip-to-tip fiberglass or carbon fiber reinforcement.

30. B. Fins are subject to aerodynamic forces that can make them flex. The amount of flexing, sometimes called fin flutter, depends on the stiffness of the fin material, but also on the shape of the fin and the velocity of the rocket. Above a critical speed, this flexing can weaken the attachment of the fin to the rocket and cause the fins to detach mid-flight. The same result could occur from poorly attached fins. When fins detach mid-flight, the CP changes, and the rocket becomes unstable.

Part 2 – Safety Questions

1) Which of the following is a complex rocket?

A. A rocket with clustered rocket motors.
B. Both A and C.
C. A rocket with more than one stage.

2) Which motor is NOT considered a high-power rocket motor?

A. A motor that has 150 Newton-seconds of total impulse, an average thrust of 60 Newtons and contains 55 grams of propellant.
B. A motor that has 200 Newton-seconds of total impulse, an average thrust of 70 Newtons and contains 80 grams of propellant.
C. A motor that has 140 Newton-seconds of total impulse, an average thrust of 85 Newtons and contains 130 grams of propellant.

3) Which of the following is considered a high-power rocket?

A. A rocket with a motor that has an average thrust in excess of 80 Newtons.
B. A rocket with a motor of more than 160 Newton-seconds of total impulse.
C. Both A and B.

4) A rocket is considered high-power if its weight including the motor is:

A. More than 1 pound.
B. More than 3.3 pounds.
C. Between 3.3 pounds and 115 pounds.

5) What payloads are NOT permitted in a high-power rocket?

A. Payloads that are flammable or explosive or intended to cause harm.
B. Both A and C.
C. Vertebrate animals.

6) A high-power rocket (not including motor) may be constructed of what materials?

A. Paper wood, fiberglass, plastic, and steel.
B. Paper, wood, fiberglass, or plastic with a minimum amount of ductile metallic when necessary for airframe integrity.
C. There are no restrictions on construction materials.

7) Who may own and possess a high-power rocket motor?

A. A person over the age of 18 who is a certified user.
B. Any member of a nationally recognized rocketry organization.
C. A Junior flying under the Tripoli Mentoring Program.

8) Who is allowed to be the flyer of record on a flight under the Tripoli Mentoring Program?

A. The Junior flyer.
B. Any adult over the age of 18.
C. The mentor, who is over 18 years of age and is certified to the level of the motor used.

9) When must the stability of a rocket be determined?

A. Before the rocket is prepared for flight.
B. If requested by the RSO at the safety inspection.
C. At design time for scratch-built rockets.

10) You are building a scratch built high power rocket using your own untested design. Which of the following methods of determining stability are NOT safe and should not be used?

A. Fly it and see if it goes straight. Mark it a "heads-up" flight on the flight card.
B. Use a simulation program like RockSim to determine CP and CG.
C. Perform a swing test.

11) You are at the launch site and decide to fly your rocket on a heavier motor than you simulated it on. Before taking the rocket to the RSO for the safety inspection, you should:

A. Do nothing. The CG is in the same place as it was with the original motor, so you don't need to recalculate it.
B. Do nothing. The heavier motor has more thrust, so you do not need to test for the CG.
C. Recalculate the CG by installing the motor, recovery system and payload and determining the balance point of the rocket as it is ready for flight.

12) The rocket motor you are using gives a 5:1 thrust-to-weight ratio for your rocket. The wind is blowing at 18 miles per hour. The RSO did not approve your rocket for flight because of its thrust-to-weight ratio. What is the best option?

A. Use a different motor that provides a higher thrust to weight ratio.
B. Protest to the launch director. You are following all of the safety guidelines.
C. Fly it anyway. You are following all of the safety guidelines.

13) Your rocket has a predicted altitude of 6000 feet. Your rocket has been approved by the RSO and the RSO has signed your flight card. However, before you can bring the rocket to the pad, a cloud cover forms and the ceiling is now 3000 feet. Which of the following options is NOT acceptable?

A. Fly the rocket as is. You have RSO approval and an RSO signed flight card.
B. Fly the rocket only when the clouds break and the RSO is allowing flights to your predicted altitude.
C. Re-prep the rocket with a smaller motor that will keep the rocket below the 3000-foot ceiling. Fill out a new flight card and return to the RSO before flight.

14) Who is responsible for ensuring that your rocket is flown in a safe manner?

A. The launch director.
B. The RSO.
C. You.

15) During the safety inspection, the RSO does not notice that you have attached your fins using the wrong type of glue for the material you are using. The rocket "shreds" upon take-off. Who is at fault?

A. The RSO because he/she approved the rocket for flight without noticing the fin attachment.
B. Your Mentor because he/she is the flyer of record.
C. You and your Mentor.

16) What is the maximum launch angle from vertical for a high-power rocket?

A. 30°.
B. 20°.
C. There is no maximum launch angle.

17) What is the maximum surface wind allowed for a safe launch?

A. 30 mph.
B. 20 mph.
C. 15 mph.

18) According to the Tripoli Unified Safety Code, a rocket must be designed to have a descent rate at the time of landing that does not exceed which value?

A. 20 feet per second.
B. 35 feet per second.
C. 50 feet per second.

19) When should the electronic deployment systems be armed?

A. In the prep area.
B. After the rocket is vertical on the launch pad.
C. After the rocket is vertical on the launch pad and unnecessary personnel have moved to a safe distance.

20) Why should anyone who is not needed to arm an electronic recovery system leave the pad when the recovery system is being armed?

A. A deployment charge could accidently fire during arming.
B. The noise made by extra people makes it harder for the person arming the recovery system to hear the altimeter signals.
C. There is no reason for unnecessary people to leave.

21) When should the motor igniter be armed?

A. Before placing the rocket on the launch pad.
B. After the rocket is vertical on the launch pad and deployment electronics are armed.
C. After the rocket is vertical on the launch pad, deployment electronics are armed, and unnecessary personnel have moved to a safe distance.

22) You will be launching your rocket on the first bank of high-power pads. When should you bring your rocket out to the pad?

A. When all of the launch pads in the same row as the pad you want to use are empty.
B. When you have been assigned a pad and all of the pads in the same row are empty.
C. When you have been assigned a pad, and range officials have announced that the pads that you will be using are open.

23) When is it safe to launch a high-power rocket?

A. After all persons have moved to safe distances from the launch pads and when the sky is clear.
B. After warning spectators and giving a 5 second countdown.
C. After A and B.

24) When can you approach a rocket that has misfired?

A. After 30 seconds have passed.
B. After one minute has passed and a range official has given you permission.
C. After two minutes have passed.

25) Your rocket has landed right next to the pad that it was launched from. When is it safe to recover your rocket?

A. After the range officials have announced that the range is open and given flyers permission to enter that part of the range.
B. When all of the rockets are cleared from the nearby launch pads.
C. As soon as it lands.

26) When is it permissible to catch a high-power rocket?

A. It is never permissible to catch a high-power rocket.
B. If the rocket weights less than 2.2 pounds or 1 kg.
C. If the rocket is falling slowly enough that it is deemed not to be a hazard.

27) You are in the spectator area. The LCO announces a heads-up flight. You should:

A. Continue prepping your own rocket. You know enough about rockets to know that you'll be able to see anything coming towards you.
B. Stand up, face the launch area, and keep your eye on the rocket until the recovery system has deployed and the rocket has landed or is drifting away from the launch and spectator area.
C. Stand up, face the launch area, and pay attention until the rocket has left the launch pad.

28) What additional hazards for spectators and launch participants might be associated with a motor CATO?

A. Pieces of the rocket may become detached and fall to the ground without a safe recovery system.
B. The motor-based ejection charge can fail which leads to failure to deploy the recovery system and ballistic return to the ground.
C. Both A and B.

29) When your rocket lands, it becomes entangled in a power line. Which of the following is true?

A. You can retrieve the rocket after calling the electric company and informing them that you are doing so.
B. You can retrieve the rocket without notifying the electric company if part of the rocket is on the ground.
C. According to the Tripoli Unified Safety Code, you shall not try to retrieve the rocket. Instead, you should notify the electric company as soon as possible, and allow the electric company to retrieve the rocket.

30) When your rocket lands, it becomes entangled in a power line. When can you approach the power line to retrieve the rocket?

A. When your mentor says that it is safe to do so.

B. After you have alerted the power company and told them that you will be removing it.

C. It is never safe to approach the power line to retrieve your rocket. You must wait for the electric company to retrieve it.

Part 2 - Safety Question Answers

1. B. Per the definition of a Complex Rocket in the Tripoli Unified Safety Code - **Complex Rocket:** A rocket containing multiple rocket motors.

2. A. Per the definition in the Tripoli Unifies Safety Code – High Power Rocket Motor: A motor which meets any of the following criteria:
   - Exceeds 80 Newtons average thrust, or
   - An impulse greater than 160 Newton-seconds up to 40,960 Newton-seconds (upper limit of an O motor), or
   - Which has had metal particles added to intentionally create a shower of sparks effect.

   Note the use of the "or" in the list above. If any one of the three criteria holds, the motor is a high-power motor.

3. C. Per the definition in the Tripoli Unified Safety Code - Also referred to as a Class 2 rocket by FAR 101.22, a High-Power Rocket is a rocket other than a Model Rocket that contains a motor or motors having a combined total impulse of 40,960 Newton-seconds or less.

4. B. Rockets that weigh less than 3.3 pounds are considered Class 1 or Model Rockets. There is no defined weight maximum for a high-power rocket, but the maximum total impulse of 40,960 Newton seconds and recommended thrust to weight ratios will combine to limit the overall weight of a high-power rocket.

5. B. Per the Tripoli Unified Safety Code, Section 7-9 - Rockets flown at Tripoli Launches may not carry any of the following:
   - Vertebrate animals
   - Hazardous Payloads including those which are poisonous, flammable, incendiary, or explosive.

6. B. Per the Tripoli Unified Safety Code, Section 7-1.1 - Construction; rockets shall be built using lightweight materials, such as paper, wood, plastic, rubber, or when necessary ductile lightweight metals, and construction techniques that are suitable for the planned flight.

7. A. Only a person who is a certified user can own and possess a high-power rocket motor and be the flyer of record on a mentored high-power flight. A Junior flying under the Tripoli Mentoring Program must work with a certified user who will handle the motor.

8. C. The Tripoli Mentoring Program allows Juniors to fly high power rockets that have been built by the Junior, but federal regulations and Tripoli codes insist that only certified adults can own and use high power rocket motors. Only a certified adult can be the flyer of record on a high-power flight. Junior flyers can put their name on the flight card along with the flyer of record.

9. A. Range officials perform inspections for the purpose of catching any lapses in construction and design quality, but it is the flyer’s responsibility to ensure that the rocket has been designed and constructed in a safe manner and is stable. Although rockets built from kits will often be stable when built as instructed, this is not always the case. You must always check your rocket’s stability.

10. A. It is your responsibility to ensure that your rocket is stable before taking it out to the pad. It is never acceptable to fly a high-power rocket if you are not sure that it is stable.

11. C. The weight of the motor has an effect on CG, so you must calculate the CG of a rocket separately for each motor that you use.

12. A. On a windy day, the guideline 5:1 thrust-to-weight ratio is not high enough. “Faster” motors with higher initial thrust are needed to prevent weather cocking or skywriting. NEVER fly a rocket that has not passed the safety inspection (The range officials would never allow this anyway).

13. A. The RSO performs safety checks to catch any lapses in safety. The LCO would also perform a check and would likely notice the situation. But, even if range officials miss these safety checks, individual flyers have an inherent responsibility to make sound judgments and fly safely. Never launch a rocket into a cloud.

14. C. Range officials will perform safety checks and will be monitoring flight activity for the purpose of catching any lapses in safety, but every flyer is responsible for ensuring that his or her rocket follows all safety guidelines and is flown safely. Your mentor is the flyer of record and, therefore, is also responsible for your flights. You and your mentor together must be able to guarantee that you are flying safely.

15. C. Every flyer must take every action to ensure that his/her rockets are safe to fly. Safety inspections and attentive mentoring help to decrease the number of failed flights. But every person who constructs and launches a rocket bears the responsibility for ensuring that their construction is safe and competent. Because your mentor is the flyer of record, he/she does bear overall responsibility for the flight, so it is important to listen to your Mentor’s guidance.

16. B. Per the Tripoli Unified Safety Code, Section 13-6 - A High-Power Rocket must be launched no more than 20° from vertical. Deviations from vertical should only be made to limit wind drift and any deviation must be approved by the RSO.

17. B. Per the Tripoli Unified Safety Code, Section 9-3 - No rockets shall launch when the sustained surface winds exceed 20 MPH (32 KPH).

18. B. The Tripoli Unified Safety Code (TUSC 11-1) requires that rockets be designed not to land with a descent rate which exceeds 35 feet per second. 20 feet per second is a “recommended” maximum descent rate.

19. C. Per the Tripoli Unified Safety Code, **Electronic recovery or devices shall remain inhibited until the rocket has been raised to launch position but before the launch igniter is connected to the launch control system.** This is because the movement of the rocket to launch position could cause firing circuits to function inadvertently. Also, because malfunctions of the electronics when armed, or errors made in the arming process, could cause firing circuits to function inadvertently, all unnecessary personnel should leave the launch area as a safety measure.

20. A. As noted previously, malfunctions of the electronics when armed, or errors made in the arming process, could cause firing circuits to function inadvertently. Therefore, all unnecessary personnel should leave the launch area as a safety measure.

21. C. The igniter should be the last item addressed at the launch pad. It should be inserted into the rocket motor and connected to ignition leads with all unnecessary personnel departed from the pad area as a safety measure.

22. C. Range officials are in charge of the safe movement of flyers and rockets in the range area. They will ensure the flyer has a pad assignment, and will determine when the pad is safe to be accessed. A flyer should never proceed anywhere on a live rocket range without the permission of range officials.

23. C. Range officials are responsible for ensuring all participants are within safe distance definitions per Tripoli Unified Safety Code table 13.17 prior to launching any rocket, and that the sky is sufficiently clear of clouds and overflying aircraft in accordance with FAR 101.23, FAR 101.25, and Section 9 of the Tripoli Unified Safety Code. Also, per the Tripoli Unified Safety Code section 9 each rocket launched must be clearly announced before giving at least a 5-second countdown.

24. B. Occasionally, a motor may ignite shortly after an igniter appears to have failed. For that reason, never approach a rocket which has had an igniter failure until at least one minute has passed and a range official has given you permission to approach the launch pad.

25. A. Range officials are in charge of the safe movement of flyers and rockets in the range area. You must never enter the range until range officials have given permission to do so.

26. A. Per the Tripoli Unified Safety Code Section 11-5 - No attempt should be made to catch a rocket. Note that this prohibition covers all rockets at a Tripoli Launch.

27. B. Section 7-11 of the Tripoli Unified Safety Code says: Spectators shall follow all directives by launch personnel. Failure to comply will result in being required to leave. Whenever "Heads-Up" is called by the LCO that is a directive to all persons in the launching, prepping, spectator, and parking areas. A Heads-Up directive is a common directive that requires that people shall stand, if possible, and pay attention to the countdown, launch, and flight of a rocket as long as necessary to ensure safe operations.

28. C. Depending on the timing, altitude (if any) and type of CATO, the rocket's airframe and/or motor may project parts and debris into the spectator area. If the rocket remains intact and continues in flight, the CATO may have damaged/disabled a motor-based ejection charge, allowing the rocket to fall into a spectator area without proper recovery deployment.

29. C. Never attempt to recover a rocket from an area that is hazardous to people. Per the Tripoli Unified Safety Code Section 11-4: No attempts shall be made to retrieve a rocket from a power line.

30. C. Never attempt to recover a rocket from an area that is hazardous to people. Per the Tripoli Unified Safety Code Section 11-4: No attempts shall be made to retrieve a rocket from a power line.