Inspections

Session Time: Three, 50-minute sessions

DESIRED RESULTS

ESSENTIAL UNDERSTANDINGS

The intended purpose and use of an aircraft drives aircraft design considerations and construction techniques, materials, and components. (EU 1)

A deep understanding of how an aircraft operates enables a pilot to fly the aircraft to its maximum capabilities in both normal and abnormal situations. (EU 4)

ESSENTIAL QUESTIONS

1. Why do aircraft require more frequent and thorough inspections than automobiles?
2. Are these inspections sufficient to ensure safety?

LEARNING GOALS

Students Will Know

- The type and frequency of required aircraft inspections
- The types of items inspected

Students Will Be Able To

- *Differentiate* between the inspections required for aircraft used for recreation and those used for hire. (DOK-L3)
- *Summarize* the items included in a preflight inspection. (DOK-L2)
- *Design* a personal pre-activity checklist. (DOK-L4)
- *Analyze* a preflight inspection checklist and explain its importance. (DOK-L4, DOK-L2)

ASSESSMENT EVIDENCE

Warm-up
Recalling what they have learned of aircraft systems, students will list what they believe are the five most important aircraft systems or parts to check on a preflight inspection.

Formative Assessment
Students will demonstrate what they have learned by answering questions from the Remote Pilot and Private Pilot Knowledge Tests.

Summative Assessment
Students will examine a sample checklist for a preflight inspection. For each item listed, they should explain what they are looking for and why it matters.

LESSON PREPARATION

MATERIALS/RESOURCES

- Inspections Presentation
- Inspections Student Activity 1
- Inspections Student Activity 2 **(Alternate)**
- Inspections Student Activity 3
- Inspections Student Activity 4
- Inspections Teacher Notes 1
- Inspections Teacher Notes 2 **(Alternate)**
- Inspections Teacher Notes 3
- Inspections Teacher Notes 4
- c172 checklist
  samples can be found online, including at http://www.freechecklists.net/ or purchased through Amazon ($9) or any pilot supply shop

Flight Simulation Activity (Optional)

- Flight simulation software with add-on for walkaround preflight inspection, such as X-Plane
  - Cessna 172SP Skyhawk, designed by AirfoilLabs ($34.95)
    https://store.x-plane.org/Cessna-172SP-Skyhawk_p_401.html#tab-1

Teaching Tips

The second session of this lesson is intended to be a field trip to a flight school so that students can walk through a preflight inspection with a pilot or flight instructor. Ideally, the school selected would also have a maintenance area, so that students can see an aircraft being inspected or repaired. You will want to schedule this field trip ahead of time.

If this is not possible, an alternative activity is provided in **Inspections Student Activity 2**.

LESSON SUMMARY

Lesson 1: Airplane Flight Manual (AFM) and Pilot's Operating Handbook (POH)
Lesson 2: Registration and Airworthiness Certificates
Lesson 3: Inspections

The lesson will begin with an introduction to aircraft maintenance and inspections as well as the federal regulations that govern these activities. The lesson will also highlight the responsibilities of the aircraft owner and operator.

The next part of the lesson discusses the different types of inspections for general aviation, specifically the annual, 100 hour, and preflight inspections. The lesson will cover the different systems and components that need to be inspected. The main instruction of the lesson will conclude with a brief summary of sUAS inspections. The first session ends with a formative assessment, in which students answer questions from the FAA Private Pilot and Remote Pilot Knowledge Tests.

The second session of the lesson is intended to be a field trip, so that students gain hands-on experience with inspections and maintenance. If this is not possible, an alternative activity is provided.

In the third session, students will have the chance to create their own checklist for a "pre-ride" inspection of a bicycle. Finally, they will complete the summative assessment for this lesson by examining a sample checklist for a preflight inspection and explaining what they are looking for in each item and why it matters.

If there is time in the third session, consider using flight simulation software to enhance the training on preflight inspections. Some software, like X-Plane, offers an add-on for a walkaround preflight.

BACKGROUND

Federal Aviation Regulation Part 91.7 says that "no person may operate a civil aircraft unless it is in an airworthy condition." Specific documents and thorough inspections determine an aircraft's airworthiness. A variety of documents must be on board the aircraft in order for it to be legal to fly, and it is the responsibility of pilot to check that those documents are aboard.

Inspection requirements differ with the various uses of aircraft. For example, aircraft being used for compensation or hire must be inspected every 100 hours. Most aircraft, including those used for compensation or hire, are required to have a complete inspection every year. FAA regulations stipulate who can perform and sign off on these inspections, as well as the items to be inspected.

Before every flight, an aircraft must go through a preflight inspection, which includes verifying its airworthiness and visually inspecting the aircraft. Generally speaking, the inspection should include documents, cabin interior, lights, fuel, oil, airfoil surfaces, control surfaces, engine and exhaust systems, landing gear system, tiedowns, baggage, presence of ice, and visibility through windshield.

MISCONCEPTIONS

Many assume that inspection and maintenance cycles are determined by the Hobbs Meter, the familiar instrument which counts time when the engine is running. This is the time that pilots put in their logbooks and the time they are billed if renting the aircraft. Maintenance times, though, are kept using “tach time,” which is recorded on the tachometer. Tach time is only counted when the engine reaches a certain RPM, in effect counting when the aircraft is in the air, not on the ground with the engine running. Students may also assume that an annual inspection must be performed on the same date each year. In fact, such time-based inspection cycles usually allow the inspection to take place in the same calendar month, so that an inspection performed on March 10 one year must be performed no later than March 31 of the following year.

DIFFERENTIATION

To support student memory and recall throughout the lesson, have students create a graphic organizer by folding a piece of paper in half, vertically. At the top left column, have them write “Preflight Inspection Area.” At the top right column, have them write “Notes.” Students can jot down what items must be checked during the preflight inspection. They can then use these notes to support recall as the lesson progresses.

LEARNING PLAN

ENGAGE

Teacher Material: Inspections Presentation

Slides 1-3: Introduce the topic and learning objectives of the lesson.

Slide 4: Conduct the **Warm-Up**.

Warm-Up

Recalling aircraft systems learned in previous lessons, ask students to list the five most important aircraft systems or parts they think should be checked before flying. Students should share their lists with a partner and discuss the similarities/differences between them. When students have completed this

discussion, ask each group to share one item from their list. Write their responses down so they can see how their ideas compare to an actual preflight checklist as the lesson progresses.

[DOK-L4; *Create*]

EXPLORE

Teacher Material: Inspections Presentation

Slide 5: Years of operating experience have taught aircraft owners, mechanics, and regulators that periodic inspections can identify potential problems before they cause an accident, increasing aircraft safety. Inspection cycles are determined by regulations and manufacturer requirements based on operating history. Parts that aren't airworthy are replaced as a result of inspections. It is the responsibility of the pilot or operator to ensure that inspections are completed on schedule.

Slide 6: The Federal Aviation Administration (FAA) is responsible for creating regulations that promote aviation safety. The FAA accomplishes these goals through the Code of Federal Regulations (CFR). FAA regulations are listed in Title 14 of the Code, "Aeronautics and Space," which includes all aspects of civil aviation, from how to earn a pilot's certificate to maintenance of an aircraft. Specific regulations are usually written as "14 CFR Part #," e.g., 14 CFR Part 91. The different parts cover different topics and types of operations. Each part is further broken down into subchapters with letters, such as 14 CFR Part 91 A.

In this lesson, students will learn about the requirements under Part 91, which governs non-commercial general aviation operations. Other Parts will be mentioned in a later slide but not examined in detail.

Slide 7: Inspection schedules are defined by regulation based on the type of operation:

- Public Use governs government aircraft (e.g., law enforcement, non-compensated medevac operations, aerial firefighting)
- Part 91 refers to flight rules for general aviation
- Part 135 refers to flight rules for corporate and commercial operations
- Part 121 refers to scheduled air carriers (most regional and major airlines)

Questions

Why do different types of operations need different rules?
Answer: Aircraft in private use are subject to fewer regulations and inspections than those used for commercial purposes. Regulations and inspections for scheduled air carriers are stricter still. The different Parts in the regulations reflect the idea that the greater the potential effect on the public, the more stringent the regulations.

The environment an aircraft operates in also affects maintenance requirements. For example, an airplane that operates near salt water will likely sustain increased corrosion to metal components. Dry climates may cause rubber hoses and tires to "dry out" prematurely. Humid environments increase the likelihood of corrosion and moisture in the fuel system, avionics, and other electrical components.

Slide 8: Although aircraft owners and operators are primarily responsible to ensure the safety and airworthiness of their aircraft with required inspections and maintenance, the aircraft or component manufacturer has an obligation provide the owner/operator with updated safety and service information. This information includes:

- maintenance manuals: to provide instruction on how to perform the maintenance
- replacement parts: to change out outdated or worn components
- service bulletins: to alert operators/owners to urgent necessary maintenance
- component recalls: to alert operators/owners when there is a defect in a component

Point out the “Service Bulletin” as a way manufacturers notify operators and maintainers of the information.

Slide 9: Civil aircraft require inspections at specific intervals. All aircraft must be inspected at least every 12 calendar months, known as an annual inspection. The annual inspection is like going to the doctor yearly for a check-up.

All aircraft under 12,500 lbs that are used for hire also require an inspection every 100 flight hours. This includes aircraft used for flight training.

Slide 10: Different types of inspections occur on different schedules. These schedules may be based on calendar time, time in service, cycles, or a combination of these things.

- Calendar time. Some inspections, like the annual inspection, are required at time intervals based on the calendar. A calendar month refers to time between the first and last day in a month. An inspection due in a calendar month must be completed by the last day in that month.
- Time in service. A tachometer measures how many hours an aircraft is operated, and this is used to determine the inspection cycle. For example, the 100-hour inspection must be conducted every 100 hours of time in service as measured by the tachometer.
- Number of system operations or cycles. An inspection may be required on how many times a system is used, such as the number of landing gear cycles or the use of a rescue hoist. Point out the rescue hoist image on the slide, and explain that inspection criteria are often component-specific. A rescue hoist has its own inspection and service life criteria.
- Combinations of the above criteria: Normally, the most conservative or first limitation to be reached will require an inspection. For example, inspect every calendar year or 200 hours of operation, whichever comes first.

Slide 11: Use this slide to review the types of inspections. The federal regulations that govern each type are shown in brackets.

Teaching Tips

To help students remember the types of inspections, use the acronym AVIATE. The acronym uses the letter “I” as a memory aid for the number “1” in 100:

A – Annual Inspection [FAR 91.409(a)]
V – VOR Check (every 30 days) (IFR-only) [FAR 91.171]
I – 100-hour Inspection (for hire only) [FAR 91.409(b)]
A – Altimeter/Pitot Static System (24 calendar months) (IFR-only) [FAR 91.411]
T – Transponder (Every 24 Calendar Months) [FAR 91.413]
E – Emergency Locator Transmitter (ELT) (Every 12 months) [FAR 91.207(c)(d)]

If time permits, consider having students look up the requirements for each inspection in the Federal Aviation Regulations. The location of each of these requirements is listed in parenthesis above.

Slides 12: The purpose of an annual inspection, like any inspection, is to find things that may need repair or replacement. During an annual, components such as seats are removed to give access to places that can't normally be viewed, so as to discover hidden problems.

If an annual inspection has not been performed within the preceding 12 calendar months, the aircraft cannot be flown. For example, if the inspection was performed on March 10, 2019, the aircraft must have another inspection no later than March 31, 2020 to fly legally.

If time allows, consider showing this short video about an annual inspection:

- "Maintenance Monday - Annual Inspection" (Length 2:11)
  https://video.link/w/uXAh

Slide 13: If an aircraft is used for hire or for flight instruction, an inspection must be performed for every 100 hours flown. The aircraft can be flown for up to an additional 10 hours in order to get it to a facility where the maintenance can be performed. However, that time is subtracted from the time before the next 100-hour inspection is due. For example, if an inspection is due at 100 hours but is not actually performed until 103 hours, the next inspection will be due 97 hours later at 200 hours.

An annual inspection can be substituted for a 100-hour inspection, but the reverse is not true.

If time allows, consider showing this video about 100 Hour inspections.

- "Maintenance Monday - 100 Hour Inspections" (Length 4:56)
  https://video.link/w/jNAh

Slide 14: A VOR is a ground-based radio transmitter used for aerial navigation. In order to use VORs for navigation under instrument flight rules (IFR), the VOR receiver in the aircraft must be checked every 30 days. This is a check the pilot or a maintenance shop can perform as described in the following video.

- "VOR Accuracy Checks" (Length 5:33)
  https://video.link/w/AQAh

Slide 15: The inspection of the altimeter includes the altimeter, encoding altimeter, and their associated systems is required every 24 months prior to operating in controlled airspace under instrument flight rules (IFR).

Slide 16: The transponder is a radar beacon transmitter/receiver installed in the aircraft which communicates with air traffic control radar. This supplements an air traffic controller's radar by providing additional information, such as altitude, to the controller. The transponder also transmits a four digital code to the controller, known as a "Squawk," that allows the controller to distinguish an individual aircraft from all the others on their scope. An aircraft not squawking appears as a simple blip on the radar, with no altitude information. Transponders are required in controlled airspace and must be tested every 24 months.

Slide 17: Every 12 months, the Emergency Locator Transmitter (ELT) must be inspected. The ELT is a radio transmitter that aids in the locating of a downed aircraft by transmitting an audio tone on the "guard" frequencies (121.5 & 243.0). The device operates from its own power source and will automatically function after a mishap. The inspection consists of the following:

- proper installation
- battery corrosion
- operation of the controls and crash sensor

- sufficient signal radiated from antenna

The ELT is tested in accordance with the manufacturer's recommendations. Testing of the transmitter is only authorized during the first five (5) minutes of any hour and only for a maximum three audio “sweeps” of the transmitter.

Because the ELT operates on battery power, the batteries must also be replaced or recharged regularly. Any time the ELT has been used for more than one hour (cumulative time) or when the batteries are reduced to 50 percent of their useful life or charge.

Slides 18-19: What happens if an aircraft component fails and the pilot lands at a location where repairs cannot be made?

Before a pilot can fly an aircraft that has inoperable instruments or equipment, the local FAA Flight Standards District Office (FSDO) must issue a “Special Flight Permit,” often called a “ferry permit.” This permit can be issued after an authorized mechanic determines aircraft is safe for flight and makes an appropriate logbook entry.

This type of permit is usually issued to move the aircraft to a different location where maintenance or repairs can be made, but there are other reasons that this permit may be issued, including for the delivery of an aircraft to a new owner or to move the aircraft from an area of impending danger, such as moving an aircraft out of the path of a hurricane.

EXPLAIN

Teacher Materials: Inspections Presentation, Inspections Teacher Notes 1
Student Material: Inspections Student Activity 1

Slide 20: Complete the **Formative Assessment**. This will likely complete the first session.

> **Formative Assessment**
>
> In this activity, students will demonstrate what they have learned by answering questions from the FAA’s Remote Pilot and Private Pilot Knowledge Tests. Distribute a copy of **Inspections Student Activity 1** to each student. Correct answers are provided in **Inspections Teacher Notes 1**.
>
> [DOK-L3; *Apply*]

Slide 21: This lesson now transitions to focus on the preflight inspection of an aircraft. For the purposes of this lesson, we will focus on a single-engine airplane.

There is more to a preflight than simply a visual inspection of the airframe. Explain that the logbooks, weight and balance forms, and other required documents must be reviewed to ensure the aircraft is airworthy. Students should recall that they learned about weight and balance calculations and logbooks in previous lessons.

Slide 22: When a pilot performs a preflight inspection, he or she must review the aircraft logbooks and maintenance records and check that all required documents are on board to ensure that the aircraft is airworthy.

Slide 23: The image shows the documents required to be carried in the aircraft. Briefly review the documents listed, and use the acronym ARROW as a memory aid.

- A = Airworthiness Certificate
- R = Registration
- R = Radio Station License
- O = Operating Limitations (AFM/POH)

- W = Weight & Balance

Slide 24: Pilots use several techniques to ensure that nothing is missed in the preflight inspection. Using a printed or digital checklist helps ensure that all critical items are examined. Using a "flow" helps reinforce the checklist and ensure nothing is overlooked. A "flow" simply refers to doing the same thing in the same way each time, and doing it in an order that makes sense. This means starting the inspection at the same place each time, walking around the aircraft in the same direction each time, and performing the same checks in the same order each time. Most pilots are taught to start their check in the cabin where they can ensure the engine is off, control surfaces are unlocked, and required documents are aboard. They then typically flow circle the aircraft beginning with the left side, checking all required items until they are back where they started.

Slide 25: Instructions for performing a preflight visual inspection of an aircraft are found in the AFM or POH. These instructions may include a diagram of the preferred flow and list of items to be checked before each flight.

Slide 26: When inspecting the cabin, for example, the pilot should check:

- Seat belts for operation and any fraying of the material.
- Door latch operation so doors do not inadvertently open in flight.
- For cracks or damage to the windshield.
- For signs of leaks.
- Seat rails and latches to ensure the seats lock in place.

This is also an ideal time to turn on the power to check:

- The function of aircraft lighting, including the rotating beacon, landing light, and navigation lights.
- The quantity displayed on the fuel gauge.
- That any control locks have been removed to allow free movement of control surfaces.

And, if the airplane has electrical flaps, this is a good time to extend them so they can be inspected.

Slide 27: The outer wing surface and tail section should also be inspected preflight. Here's what to look for:

- The condition and security of spar lines, rivets and screws
- General damage to the skin
    - Look for dents, cracks, bubbles, or tears, depending on whether aircraft skin type is metal, fabric, or composite. Surface deformities may be caused by, or lead to, structural weakness or failures and these deformities may be the result of broken or damaged structure under the aircraft skin.
- Operation of flaps, ailerons, elevator, rudder, and trim tabs
    - Remind students that as one aileron is deflected up, the other should be deflected down.
    - Flaps should be placed in the down position to make it easier to see the attaching bolts, control rods, and flap surface. The flaps should move through their full range and lock in position when extended.

Slides 28-29: These slides highlight the importance of the fuel checks. Many complete engine failures are due to fuel starvation, which is completely preventable.

Check for quantity, type, grade, contamination. Most general aviation aircraft have sumps (access ports) on the wings and/or belly. As a refresher from a previous lesson, remind students that 100LL fuel is blue, while jet fuel is clear.

Fuel vents, which look like small curved pipes or straws, allow air to enter the tanks to replace fuel as it is burned. This is important for keeping the air pressure inside the tank equal to air pressure outside. In some aircraft, these vents also

serve as fuel tank overflow vents to prevent tanks from rupturing, especially on hot days when fuel expands. Even a partial blockage can create a vacuum in the fuel tank, preventing fuel from flowing to the engine

Some aircraft have vented fuel caps (shown on the slide), rather than fuel vents on the wings. Some vented fuel caps must be aligned with the vent facing forward, and care must be taken to ensure they are replaced correctly.

Slide 30: Checking an aircraft's oil correlates to checking the oil in a car. Using the dipstick, the pilot should check for quantity, contamination, and color. Very dark oil may indicate contamination or excessive heat. Pilots should also be on the lookout for signs of leaks, such as oil on the ground or belly of the aircraft. Once the oil check is complete, be sure the oil filler cap is properly secured.

Slide 31: Look for the following issues when inspecting the engine and propeller (if applicable):

- Inspect the propeller for any damage and proper freedom of movement.
- Make sure the engine cowling does not have any worn, loose, and missing rivets and fasteners.
- Make sure the engine and exhaust system does not have any leaks and signs of damage/corrosion. A hole in the exhaust system could cause a carbon monoxide leak in the aircraft.
- Make sure drain plugs and oil cap are properly secured.
- Make sure there are no foreign objects inside after previous maintenance.

A video further elaborating this inspection will be presented later in this lesson.

Slide 32: When inspecting the landing gear, tires, and brakes, check for the following.

- **Tire Pressure:** Make sure the tires are properly inflated.
- **Tire Condition:** Look for bald or flat spots on the tires. Flat spots are often associated with landings made with the brakes on. Also check for bulges and other types of wear or damage.
- **Brake Pads:** Check brake pads for excessive wear.
- **Struts:** Check struts for appropriate height in accordance with manufacturer guidelines; be alert for leaks or deflated struts.

Slide 33: Ensure tie down ropes have been disconnected from the aircraft and will not interfere with ground taxi or left in a position where they could get caught in props or sucked into intakes. Many aircraft have covers for the pitot tube and plugs around air intakes. Be sure these are properly removed and stowed. Baggage, cargo, and equipment must be secured so it does not affect the aircraft's center of gravity, shift in flight, or become a projectile in turbulence. Be sure the baggage hatch or door is properly closed and latched.

Slide 34: Frost, ice, snow, and sleet must be removed before takeoff. Ice can be removed by allowing it to melt off in a warm hangar or spraying the aircraft with deicing fluid. Frost and snow can sometimes be wiped away, but it's vital that these contaminants be removed from all airfoils. Even very small amounts of frost can disrupt the airflow, causing decreased lift and increased stall speed.

Dirt or dead bugs on the windshield can not only restrict a pilot's view, but also make it hard to see and avoid traffic.

Slide 35: This video shows an example of a Cessna 172 preflight inspection

- "Fast Track-Cessna 172 Preflight" (Length 5:34)
  https://video.link/w/dcSh

Slide 36: Take a moment to highlight the preflight responsibilities of small UAS operators. Operator's should follow the guidelines in the operator's manual for their device. General guidelines include ensuring the sUAS is in safe operating condition with no visible damage and the control linkage between the controller and device are operating normally. The battery should be charged to ensure adequate power for the completion of the mission. Any cargo must be secured

appropriately. The FAA requires registration numbers must be visible on the device and that appropriate documents must be available upon request.

EXTEND

Teacher Materials: Inspections Presentation, Inspections Teacher Notes 2
Student Material: Inspections Student Activity 2

This session should be a field trip to a local flight school facility where students can watch pilots or maintenance technicians perform the inspections discussed in class. Additionally, students should be provided the opportunity to perform a preflight on an actual aircraft under the guidance of flight instructors. The class could be divided into two or more groups to facilitate these activities.

If a field trip is not possible, an alternative activity is provided in **Inspections Student Activity 2**. In this activity, students will watch a video showing the preflight inspection of a typical training airplane and a video showing a preflight of a larger commercial aircraft. Then, students will compare and contrast the two preflight inspections. Possible student responses are provided in **Inspections Teacher Notes 2**.

EVALUATE

Teacher Materials: Inspections Presentation, Inspections Teacher Notes 3, Inspections Teacher Notes 4
Student Materials: Inspections Student Activity 3, Inspections Student Activity 4, Cessna 172 Skyhawk Sample Preflight Inspection Checklist **(or another preflight checklist)**

Slide 37: Distribute a copy of **Inspections Student Activity 3** to each student. In this activity, students will create a "pre-ride" checklist for use prior to riding a bicycle, based on what they learned about preflight checklists and inspections. Students should make sure the information is generic enough to use on most bikes, but specific enough to work for a bike with which they are familiar. A sample student checklist is provided in **Inspections Teacher Notes 3**.

[DOK-L4; *Apply, Design*]

Slide 38: Conduct the **Summative Assessment**.

Summative Assessment

In this activity, students will analyze a sample checklist for a preflight inspection. For each item listed, explain what you should look for and why it matters. Provide a copy of **Inspections Student Activity 4** along with a copy of a sample preflight checklist to each student. If students are struggling, consider pairing up students so that they can work together.

Correct answers based on the sample preflight checklist that accompanies this lesson are provided in **Inspections Teacher Notes 4**.

[DOK-L4; *Analyze*]

Summative Assessment Scoring Rubric

- Answers show evidence of the following:

- An ability to summarize how to perform a preflight inspection, including what to look for
- Understanding of why checking for these items is important

- Contributions show in-depth thinking including analysis

Points	Performance Levels
10	Responses show an in-depth understanding of a preflight inspection and why it's important. Each answer provided is accurate.
8-9	Responses show a sufficient understanding of a preflight inspection and why it's important. Most answers are accurate, but 1-2 answers are inaccurate or incomplete.
6-7	Responses show a lack of understanding of a preflight inspection and why it's important with several inaccurate answers.
0-5	Responses shows little understanding of a preflight inspection and why it's important with most answers being inaccurate or incomplete.

GOING FURTHER

If there is time in the third session, consider using flight simulation software to enhance the training on preflight inspections. Some software, like X-Plane, offers an add-on for a walkaround preflight. The following video shows this add-on in action, if you wish to explore this optional simulation opportunity before letting students explore it.

- "Cessna 172 Preflight - X-Plane" (Length 20:47)
  https://video.link/w/66ai

STANDARDS ALIGNMENT

COMMON CORE STATE STANDARDS

- **RST.9-10.2** - Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
- **RST.9-10.3** - Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- **RST.9-10.4** - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
- **RST.9-10.7** - Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- **RST.9-10.9** - Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
- **WHST.9-10.2** - Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- **WHST.9-10.4** - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

- **WHST.9-10.6** - Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
- **WHST.9-10.9** - Draw evidence from informational texts to support analysis, reflection, and research.

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