

Below the Surface

Analyze a model technical explanation for sequence, precision, and limits.

CCSS.ELA-Literacy.WHST.11-12.2 "Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline transition words, number the laboratory steps in order, and circle each statement that limits what the data can show. These marks reveal how the explanation makes a process clear and accurate.

Tracking Viral Signals in Wastewater

- ① Public health teams can detect some infectious-disease signals before many patients seek care by testing wastewater. People who use toilets shed genetic material from certain viruses, including SARS-CoV-2, into sewers. At a treatment plant or sampling site, technicians collect a small, carefully timed sample from flowing wastewater. The sample represents material from many users in the connected sewershed, not from named individuals. Because the water contains detergents, food waste, and other substances that can interfere with testing, the laboratory must prepare the sample before looking for a viral signal.
- ② First, workers remove large particles and concentrate the remaining liquid so that scarce viral material is easier to measure. Next, they extract RNA, a molecule that carries genetic instructions, and use a method called reverse transcription to make DNA copies. A polymerase chain reaction, or PCR, then amplifies selected genetic sequences. Instruments record how much target material the test detects. To check that a result is trustworthy, analysts include controls, compare repeated measurements, and may measure another common virus, such as pepper mild mottle virus, to help account for changes in wastewater strength.
- ③ Finally, analysts combine laboratory results with information about the sample, such as the date, location, and flow of wastewater. They usually report trends over time rather than treating one measurement as a precise count of infected people. For example, a rising concentration across several samples can signal that viral spread may be increasing in the community. Health departments can use that warning alongside clinical testing, hospital data, and local knowledge when planning messages or services. However, wastewater data cannot reveal who is infected, and storms or industrial discharges can change the sample. Clear reports state both the finding and its limits.

2 ANSWER WITH EVIDENCE _____ Use the passage

1 Why must the laboratory prepare the wastewater sample before looking for a viral signal, and what is the first preparation action?

2 After technicians extract RNA, what does reverse transcription do, and what does PCR do?

3 What three practices does the passage name to help analysts judge whether a result is trustworthy?

4 State one way analysts interpret wastewater results and one limit they must report.

3 YOUR TURN _____ Your own words

In three paragraphs and 130 to 160 words, explain a scientific procedure, historical process, or technical process you know. Use at least three transition words, clarify one technical term, and state one limit or uncertainty that affects the conclusion.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

PART 1 • READ AND MARK

Underline transition words, number the laboratory steps in order, and circle each statement that limits what the data can show. These marks reveal how the explanation makes a process clear and accurate. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	Why must the laboratory prepare the wastewater sample before looking for a viral signal, and what is the first preparation action?	Detergents, food waste, and other substances can interfere with testing. Workers first remove large particles and concentrate the remaining liquid.
2	After technicians extract RNA, what does reverse transcription do, and what does PCR do?	Reverse transcription makes DNA copies from the RNA. PCR amplifies selected genetic sequences.
3	What three practices does the passage name to help analysts judge whether a result is trustworthy?	They include controls, compare repeated measurements, and may measure pepper mild mottle virus to account for changes in wastewater strength.
4	State one way analysts interpret wastewater results and one limit they must report.	They report trends across time rather than treating one result as an exact count of infected people. The data cannot identify who is infected, and conditions such as storms or industrial discharges can change a sample.

PART 3 • YOUR TURN (SAMPLE ANSWER)

Archaeologists can estimate when a wooden beam was cut by studying its growth rings. In temperate regions, many trees form one ring each year, with a lighter band from rapid spring growth and a darker band from slower later growth. This pattern creates a record, but a ring sequence must be compared with a known timeline before it can date an object. First, a researcher takes a narrow core or examines a cross section without destroying more wood than necessary. Next, the researcher measures the widths of consecutive rings. A distinctive sequence of narrow and wide rings is matched to a master chronology, a calendar of ring patterns built from trees whose dates are already known. Finally, if the outermost ring remains on the beam, its position can indicate the cutting year. If outer rings are missing, however, the result gives only an earlier possible date. Therefore, archaeologists report the evidence and uncertainty rather than claiming an exact year.

Accept equivalent explanations that accurately connect each procedure step to its purpose. For the open response, look for a coherent sequence, precise explanatory details, clarification of a term, and a meaningful limitation or uncertainty.