

Directions: Using the evidence you collected answering think questions and focus questions to assist in writing a well-developed response to the prompt below.

Monday May 18

Prompt:

Compare and contrast the main themes and concepts contained in “Address to Students at Moscow State University” and in “Address to the Nation on the Explosion of the Space Shuttle *Challenger*.” What claims about society and progress do both speeches make? What kinds of details do the speeches use to support the claims? Are the details similar or different? Finally, which speech is the more effective or convincing? Support your answer with evidence from both speeches.

Response:

Tuesday May 19

Directions: Follow the steps below. To receive full credit you must complete all 4 steps and write in complete sentences.

1. *Read the title and the Driving Question for this Blast.*
2. *Draft your initial response to the Driving Question in the “initial response” section*
3. *Read, highlight and annotate the blast for understanding.*
4. *Use the information provided in the blast to write a revised response to the Driving Question in the “revised response” section.*

Driving Question: What is the price of technology?

Initial Response:

Blast: The Manhattan Project

Looking back over the selections from this unit, it's fair to ask whether technological advances exact too high a price. Prometheus was sentenced to eternal punishment for stealing fire from the gods and giving it to the mortals. Members of the Lacks family were exploited and taken advantage of for years. And fear of nuclear weapons set off a chain of events that affected the world for much

In this unit, you read Albert Einstein's letter warning President Roosevelt that the Nazis were trying to develop the atomic bomb—a weapon with far greater potential for destruction than anything yet created. In response, Roosevelt agreed to fund the Manhattan Project to explore nuclear weapons. When Japan attacked Pearl Harbor in 1941 and brought the United States into the war, the Manhattan Project became much more urgent. A team of scientists worked in Los Alamos, New Mexico, an ideal testing site because it was a largely uninhabited desert. The Manhattan Project shifted from the research stage to design and construction of actual bombs in 1943.

The war in Europe ended in May 1945, but when Japan seemed ready to continue the Pacific War indefinitely, FDR's successor Harry Truman ordered the nuclear bombing of Hiroshima. On August 6, the Enola Gay dropped the first bomb, which reduced the city to rubble in an instant and killed tens of thousands of civilians. Three days later, the Americans dropped a second bomb on Nagasaki. At last, Japan surrendered to the United States, ending World War II.

Nuclear weapons continued to play a role in world affairs. The Soviet Union, which revealed itself as an enemy of the United States after World War II, soon had nuclear bombs of its own. Because the bombs had such destructive potential, the two nations hesitated to start a war that no one could win; the last half of the 20th century was a standoff or “Cold War” between the world's two most powerful nations. Rather than fighting one another, the two nations tried to get at each other by taking sides in civil wars

in Korea and Vietnam, escalating both wars into much worse conflicts than they might otherwise have been. In the United States, an anti-Communist propaganda campaign ruined the lives of countless innocent people. Both the United States and the Soviet Union spent vast sums on building nuclear weapons, instead of using the money for constructive purposes such as funding education, building new infrastructure, or supporting the arts.

How did nuclear weapons affect world affairs? What price did the world pay for this major advance in weapons technology?

Driving Question: What is the price of technology?

Revised Response:

Wednesday May 20-Friday May 22

Directions: Using the evidence you collected answer the driving questions using textual evidence from each story you read.

Driving Questions: What Steps do people take to make their dreams a reality? (Answer with evidence for every story)

First Read: The Immortal Life of Henrietta Lacks

Read

Excerpt from Prologue

THE WOMAN IN THE PHOTOGRAPH

There's a photo on my wall of a woman I've never met, its left corner torn and patched together with tape. She looks straight into the camera and smiles, hands on hips, dress suit neatly pressed, lips painted deep red. It's the late 1940s and she hasn't yet reached the age of thirty. Her light brown skin is smooth, her eyes still young and playful, **oblivious** to the tumor growing inside her—a tumor that would leave her five children motherless and change the future of medicine. Beneath the photo, a caption says her name is "Henrietta Lacks, Helen Lane or Helen Larson."

No one knows who took that picture, but it's appeared hundreds of times in magazines and science textbooks, on blogs and laboratory walls. She's usually identified as Helen Lane, but often she has no name at all. She's simply called HeLa, the code name given to the world's first immortal human cells— *her* cells, cut from her cervix just months before she died.

Her real name is Henrietta Lacks.

I've spent years staring at that photo, wondering what kind of life she led, what happened to her children, and what she'd think about cells from her cervix living on forever—bought, sold, packaged, and shipped by the trillions to laboratories around the world. I've tried to imagine how she'd feel knowing that her cells went up in the first space missions to see what would happen to human cells in zero gravity, or that they helped with some of the most important advances in medicine: the polio vaccine, chemotherapy, cloning, gene mapping, in vitro fertilization. I'm pretty sure that she—like most of us—would be shocked to hear that there are trillions more of her cells growing in laboratories now than there ever were in her body.

There's no way of knowing exactly how many of Henrietta's cells are alive today. One scientist estimates that if you could pile all HeLa cells ever grown onto a scale, they'd weigh more than 50 million metric tons—an inconceivable number, given that an individual cell weighs almost nothing. Another scientist calculated that if you could lay all HeLa cells ever grown end-to-end, they'd wrap around the Earth at least three times, spanning more than 350 million feet. In her prime, Henrietta herself stood only a bit over five feet tall.

I first learned about HeLa cells and the woman behind them in 1988, thirty-seven years after her death, when I was sixteen and sitting in a community college biology class. My instructor, Donald Defler, a gnomish balding man, paced at the front of the lecture hall and flipped on an overhead projector. He

pointed to two diagrams that appeared on the wall behind him. They were schematics of the cell reproduction cycle, but to me they just looked like a neon-colored mess of arrows, squares, and circles with words I didn't understand, like "MPF Triggering a Chain Reaction of Protein Activations."

I was a kid who'd failed freshman year at the regular public high school because she never showed up. I'd transferred to an alternative school that offered dream studies instead of biology, so I was taking Defler's class for high-school credit, which meant that I was sitting in a college lecture hall at sixteen with words like *mitosis* and *kinase inhibitors* flying around. I was completely lost.

"Do we have to memorize everything on those diagrams?" one student yelled.

Yes, Defler said, we had to memorize the diagrams, and yes, they'd be on the test, but that didn't matter right then. What he wanted us to understand was that cells are amazing things: There are about one hundred trillion of them in our bodies, each so small that several thousand could fit on the period at the end of this sentence. They make up all our tissues—muscle, bone, blood—which in turn make up our organs.

Under the microscope, a cell looks a lot like a fried egg: It has a white (the *cytoplasm*) that's full of water and proteins to keep it fed, and a yolk (the *nucleus*) that holds all the genetic information that makes you *you*. The cytoplasm buzzes like a New York City street. It's crammed full of molecules and vessels endlessly shuttling **enzymes** and sugars from one part of the cell to another, pumping water, nutrients, and oxygen in and out of the cell. All the while, little cytoplasmic factories work 24/7, cranking out sugars, fats, proteins, and energy to keep the whole thing running and feed the nucleus—the brains of the operation. Inside every nucleus within each cell in your body, there's an identical copy of your entire **genome**. That genome tells cells when to grow and divide and makes sure they do their jobs, whether that's controlling your heartbeat or helping your brain understand the words on this page.

Defler paced the front of the classroom telling us how mitosis—the process of cell division—makes it possible for embryos to grow into babies, and for our bodies to create new cells for healing wounds or replenishing blood we've lost. It was beautiful, he said, like a perfectly choreographed dance.

All it takes is one small mistake anywhere in the division process for cells to start growing out of control, he told us. Just *one* enzyme misfiring, just *one* wrong protein activation, and you could have cancer. Mitosis goes **haywire**, which is how it spreads.

"We learned that by studying cancer cells in culture," Defler said. He grinned and spun to face the board, where he wrote two words in enormous print: HENRIETTA LACKS.

Henrietta died in 1951 from a vicious case of cervical cancer, he told us. But before she died, a surgeon took samples of her tumor and put them in a petri dish. Scientists had been trying to keep human cells alive in culture for decades, but they all eventually died. Henrietta's were different: they reproduced an entire generation every twenty-four hours, and they never stopped. They became the first immortal human

cells ever grown in a laboratory.

“Henrietta’s cells have now been living outside her body far longer than they ever lived inside it,” Defler said. If we went to almost any cell culture lab in the world and opened its freezers, he told us, we’d probably find millions—if not billions—of Henrietta’s cells in small vials on ice.

Her cells were part of research into the genes that cause cancer and those that suppress it; they helped develop drugs for treating herpes, leukemia, influenza, hemophilia, and Parkinson’s disease; and they’ve been used to study lactose digestion, sexually transmitted diseases, appendicitis, human longevity, mosquito mating, and the negative cellular effects of working in sewers. Their **chromosomes** and proteins have been studied with such detail and precision that scientists know their every quirk. Like guinea pigs and mice, Henrietta’s cells have become the standard laboratory workhorse.

“HeLa cells were one of the most important things that happened to medicine in the last hundred years,” Defler said.

Then, matter-of-factly, almost as an afterthought, he said, “She was a black woman.” He erased her name in one fast swipe and blew the chalk from his hands. Class was over.

As the other students filed out of the room, I sat thinking, *That’s it? That’s all we get? There has to be more to the story.*

I followed Defler to his office.

“Where was she from?” I asked. “Did she know how important her cells were? Did she have any children?”

“I wish I could tell you,” he said, “but no one knows anything about her.”

After class, I ran home and threw myself onto my bed with my biology textbook. I looked up “cell culture” in the index, and there she was, a small parenthetical:

In culture, cancer cells can go on dividing indefinitely, if they have a continual supply of nutrients, and thus are said to be “immortal.” A striking example is a cell line that has been reproducing in culture since 1951. (Cells of this line are called HeLa cells because their original source was a tumor removed from a woman named Henrietta Lacks.)

That was it. I looked up HeLa in my parents’ encyclopedia, then my dictionary: No Henrietta.

As I graduated from high school and worked my way through college toward a biology degree, HeLa cells were omnipresent. I heard about them in histology, neurology, pathology; I used them in experiments on how neighboring cells communicate. But after Mr. Defler, no one mentioned Henrietta.

When I got my first computer in the mid-nineties and started using the Internet, I searched for information about her, but found only confused snippets: most sites said her name was Helen Lane; some said she died in the thirties; others said the forties, fifties, or even sixties. Some said ovarian cancer killed her, others said breast or cervical cancer.

Eventually I tracked down a few magazine articles about her from the seventies. *Ebony* quoted Henrietta's husband saying, "All I remember is that she had this disease, and right after she died they called me in the office wanting to get my permission to take a sample of some kind. I decided not to let them." *Jet* said the family was angry—angry that Henrietta's cells were being sold for twenty-five dollars a vial, and angry that articles had been published about the cells without their knowledge. It said, "Pounding in the back of their heads was a gnawing feeling that science and the press had taken advantage of them."

The articles all ran photos of Henrietta's family: her oldest son sitting at his dining room table in Baltimore, looking at a genetics textbook. Her middle son in military uniform, smiling and holding a baby. But one picture stood out more than any other: in it, Henrietta's daughter, Deborah Lacks, is surrounded by family, everyone smiling, arms around each other, eyes bright and excited. Except Deborah. She stands in the foreground looking alone, almost as if someone pasted her into the photo after the fact. She's twenty-six years old and beautiful, with short brown hair and catlike eyes. But those eyes glare at the camera, hard and serious. The caption said the family had found out just a few months earlier that Henrietta's cells were still alive, yet at that point she'd been dead for twenty-five years.

All of the stories mentioned that scientists had begun doing research on Henrietta's children, but the Lackses didn't seem to know what that research was for. They said they were being tested to see if they had the cancer that killed Henrietta, but according to the reporters, scientists were studying the Lacks family to learn more about Henrietta's cells. The stories quoted her son Lawrence, who wanted to know if the immortality of his mother's cells meant that he might live forever too. But one member of the family remained voiceless: Henrietta's daughter, Deborah.

As I worked my way through graduate school studying writing, I became fixated on the idea of someday telling Henrietta's story. At one point I even called directory assistance in Baltimore looking for Henrietta's husband, David Lacks, but he wasn't listed. I had the idea that I'd write a book that was a biography of both the cells and the woman they came from—someone's daughter, wife, and mother.

I couldn't have imagined it then, but that phone call would mark the beginning of a decadelong adventure through scientific laboratories, hospitals, and mental institutions, with a cast of characters that would include Nobel laureates, grocery store clerks, convicted felons, and a professional con artist. While trying to make sense of the history of cell culture and the complicated ethical debate surrounding the use of human tissues in research, I'd be accused of conspiracy and slammed into a wall both physically and metaphorically, and I'd eventually find myself on the receiving end of something that looked a lot like an exorcism. I did eventually meet Deborah, who would turn out to be one of the strongest and most resilient women I'd ever known. We'd form a deep personal bond, and slowly, without realizing it, I'd become a character in her story, and she in mine.

Deborah and I came from very different cultures: I grew up white and agnostic in the Pacific Northwest, my roots half New York Jew and half Midwestern Protestant; Deborah was a deeply religious black Christian from the South. I tended to leave the room when religion came up in conversation because it made me uncomfortable; Deborah's family tended toward preaching, faith healings, and sometimes voodoo. She grew up in a black neighborhood that was one of the poorest and most dangerous in the country; I grew up in a safe, quiet middle-class neighborhood in a predominantly white city and went to high school with a total of two black students. I was a science journalist who referred to all things supernatural as "woo-woo stuff"; Deborah believed Henrietta's spirit lived on in her cells, controlling the life of anyone who crossed its path. Including me.

"How else do you explain why your science teacher knew her real name when everyone else called her Helen Lane?" Deborah would say. "She was trying to get your attention." This thinking would apply to everything in my life: when I married while writing this book, it was because Henrietta wanted someone to take care of me while I worked. When I divorced, it was because she'd decided he was getting in the way of the book. When an editor who insisted I take the Lacks family out of the book was injured in a mysterious accident, Deborah said that's what happens when you piss Henrietta off.

The Lackses challenged everything I thought I knew about faith, science, journalism, and race. Ultimately, this book is the result. It's not only the story of HeLa cells and Henrietta Lacks, but of Henrietta's family—particularly Deborah—and their lifelong struggle to make peace with the existence of those cells, and the science that made them possible.

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Annotations

First Read: Silent Spring

Read

From Chapter I: A Fable for Tomorrow

There was once a town in the heart of America where all life seemed to live in harmony with its surroundings. The town lay in the midst of a checkerboard of **prosperous** farms, with fields of grain and hillsides of orchards where, in spring, white clouds of bloom drifted above the green fields. In autumn, oak and maple and birch set up a blaze of color that flamed and flickered across a backdrop of pines. Then foxes barked in the hills and deer silently crossed the fields, half hidden in the mists of the fall mornings.

Along the roads, laurel, viburnum and alder, great ferns and wildflowers delighted the traveler's eye through much of the year. Even in winter the roadsides were places of beauty, where countless birds came to feed on the berries and on the seed heads of the dried weeds rising above the snow. The countryside was, in fact, famous for the abundance and variety of its bird life, and when the flood of migrants was pouring through in spring and fall people traveled from great distances to observe them. Others came to fish the streams, which flowed clear and cold out of the hills and contained shady pools where trout lay. So it had been from the days many years ago when the first settlers raised their houses, sank their wells, and built their barns.

Then a strange **blight** crept over the area and everything began to change. Some evil spell had settled on the community: mysterious maladies swept the flocks of chickens; the cattle and sheep sickened and died. Everywhere was a shadow of death. The farmers spoke of much illness among their families. In the town the doctors had become more and more puzzled by new kinds of sickness appearing among their patients. There had been several sudden and unexplained deaths, not only among adults but even among children, who would be **stricken** suddenly while at play and die within a few hours.

There was a strange stillness. The birds, for example—where had they gone? Many people spoke of them, puzzled and disturbed. The feeding stations in the backyards were deserted. The few birds seen anywhere were **moribund**; they trembled violently and could not fly. It was a spring without voices. On the mornings that had once throbbed with the dawn chorus of robins, catbirds, doves, jays, wrens, and scores of other bird voices there was now no sound; only silence lay over the fields and woods and marsh.

On the farms the hens brooded, but no chicks hatched. The farmers complained that they were unable to raise any pigs—the litters were small and the young survived only a few days. The apple trees were coming into bloom but no bees droned among the blossoms, so there was no pollination and there would be no fruit.

The roadsides, once so attractive, were now lined with browned and withered vegetations as though

swept by fire. These, too, were silent, deserted by all living things. Even the streams were now lifeless. Anglers no longer visited them, for all the fish had died.

In the gutters under the eaves and between the shingles of the roofs, a white granular powder still showed a few patches; some weeks before it had fallen like snow upon the roofs and the lawns, the fields and the streams.

No witchcraft, no enemy action had silenced the rebirth of new life in this stricken world. The people had done it themselves.

This town does not actually exist, but it might easily have a thousand **counterparts** in America or elsewhere in the world. I know of no community that has experienced all the misfortunes I describe. Yet every one of these disasters has actually happened somewhere, and many real communities have already suffered a substantial number of them. A grim specter has crept upon us almost unnoticed, and this imagined tragedy may easily become a stark reality we all shall know.

Excerpted from *Silent Spring* by Rachel Carson, published by Houghton Mifflin Company.

Annotations

First Read: A Civil Action

Read

Excerpt from Chapter 2

Anne thought it strange that three cases of leukemia should occur in the same neighborhood, within a few blocks of each other. She wondered if it was coincidence or if a virus of some sort was circulating. Dr. Truman, she remembered, had mentioned that some cancer researchers suspected a virus might cause childhood leukemia. Although she knew that was an unproven **hypothesis**, she and Carol Gray spent hours speculating about it. ...

During a visit to the clinic at Massachusetts General that spring, Anne told Dr. Truman about the Zonas and the Nagles. Wasn't it unusual, she asked, that there were three cases in the same neighborhood?

Truman listened in his polite, attentive manner, tall frame slightly stooped, but he would admit later that he did not give Anne's question any serious consideration. He'd learned over the years that parents of children with leukemia tended to develop a heightened awareness of the illness. Everywhere they turned it seemed they encountered a reference to it, or someone else whose child had it. To Truman, this was not an uncommon psychological phenomenon. Many years later, in a deposition, Truman recalled his reaction to Anne's queries: "My response was that on the basis of the number of children with leukemia that I was aware of at the time, and considering the population of the city of Woburn, I did not think the **incidence** of leukemia appeared to be increased. In essence, I dismissed her suggestion."

Nor did it occur to Truman a year later, in June 1973, that there was anything unusual about the illness of a two-and-a-half-year-old boy from Woburn named Kevin Kane, Jr. The boy had been referred to Truman from Winchester Hospital where his mother, a nurse, had taken him because of a persistent fever, pallor, and irritability. Two weeks earlier he had been treated unsuccessfully for a respiratory infection that did not respond to penicillin. His history on presentation at Winchester Hospital included several respiratory infections as well as recurrent episodes of earaches. Winchester referred Kevin Kane to Dr. Truman at Massachusetts General with a "high suspicion" of acute lymphocytic leukemia. Truman confirmed the suspicion. He began treating Kevin Kane on a chemotherapy **regimen** similar to the St. Jude protocol. The child responded well. At four weeks, a bone marrow aspiration revealed that he was in remission.

Kevin Kane, Sr., and his wife, Patricia, lived with their four children on Henry Avenue in east Woburn. Henry Avenue curved around the perimeter of a low bluff overlooking the Aberjona marsh. From the back door of the Kanes' house, looking east across the expanse of marsh, you could see the houses of the Pine Street neighborhood a quarter of a mile away. If you looked closely, you could see Orange Street and, through the trees, the red-shingled ranch house of the Andersons.

Anne found out about the Kanes' child from Carol Gray, whose fourteen-year-old son delivered the *Woburn Daily Times* every afternoon along Henry Avenue. In the summer of 1973, as Carol's son made his rounds, he learned that one of the Kanes' children had leukemia. He reported the news to his mother, who went immediately to the phone and called Anne. "What the hell is going on here?" Carol said to Anne.

With the discovery of yet another leukemia case, Anne began writing down some of her thoughts. She made the first of many lists of the cases she knew about, writing in a spiral notebook the names of the children, their addresses, their ages, and the dates when she figured they had been diagnosed.

The **notion** that each case shared some common cause began to obsess her. "The water and the air were the two things we all shared," she said in a deposition some years later. "And the water was bad. I thought there was a virus that might have been transmitted through the water, some kind of a leukemia virus. The water had never tasted right, it never looked right, and it never smelled right. There were times when it was worse than others, usually during the summer, and then it was almost impossible to drink. My mother would bring some water from Somerville to the house on weekends, probably about three quarts, which we used as drinking water. The rest of the time, when we could mask the flavor of it with Zarex or orange juice or coffee or whatever, then we used water from the tap. But you couldn't even mask it. It ruined the dishwasher. The door **corroded** to such a degree that it had to be replaced. The prongs that hold the dishes just gave way and broke off. On a regular basis, the pipes under the kitchen sink would leak, and under the bathroom sink. The faucets had to be replaced. The bathroom faucet dripped constantly. It seemed like no sooner would I get everything fixed and we'd have another problem."

Excerpted from *A Civil Action* by Jonathan Harr, published by Vintage Books.

Annotations

First Read: Einstein's Letter to the President

Read

Albert Einstein
Old Grove Road
Nassau Point
Peconic, Long Island

August 2nd, 1939

F.D. Roosevelt
President of the United States
White House Washington, D.C.

Sir:

Some recent work by E. Fermi and L. Szilard, which has been communicated to me in **manuscript**, leads me to expect that the element uranium may be turned into a new and important source of energy in the immediate future. Certain aspects of the situation which has arisen seem to call for watchfulness and if necessary, quick action on the part of the Administration. I believe therefore that it is my duty to bring to your attention the following facts and recommendations.

In the course of the last four months it has been made probable through the work of Joliot in France as well as Fermi and Szilard in America—that it may be possible to set up a nuclear **chain reaction** in a large mass of uranium, by which vast amounts of power and large quantities of new radium-like elements would be generated. Now it appears almost certain that this could be achieved in the immediate future.

This new phenomenon would also lead to the construction of bombs, and it is **conceivable**— though much less certain—that extremely powerful bombs of this type may thus be constructed. A single bomb of this type, carried by boat and exploded in a port, might very well destroy the whole port together with some of the surrounding territory. However, such bombs might very well prove too heavy for transportation by air.

The United States has only very poor ores of uranium in **moderate** quantities. There is some good ore in Canada and former Czechoslovakia, while the most important source of uranium is in the Belgian Congo.

In view of this situation you may think it desirable to have some permanent contact maintained between the Administration and the group of physicists working on chain reactions in America. One possible way of achieving this might be for you to **entrust** the task with a person who has your confidence and who could

perhaps serve in an unofficial capacity. His task might comprise the following:

a) to approach Government Departments, keep them informed of the further development, and put forward recommendations for Government action, giving particular attention to the problem of securing a supply of uranium ore for the United States.

b) to speed up the experimental work, which is at present being carried on within the limits of the budgets of University laboratories, by providing funds, if such funds be required, through his contacts with private persons who are willing to make contributions for this cause, and perhaps also by obtaining co-operation of industrial laboratories which have necessary equipment.

I understand that Germany has actually stopped the sale of uranium from the Czechoslovakian mines which she has taken over. That she should have taken such early action might perhaps be understood on the ground that the son of the German Under-Secretary of State, von Weizsacker, is attached to the Kaiser-Wilhelm Institute in Berlin, where some of the American work on uranium is now being repeated.

Yours very truly,

Albert Einstein

Annotations

First Read: Address to the Nation on the Explosion of the Space Shuttle Challenger

Read

January 28, 1986

Ladies and gentlemen, I'd planned to speak to you tonight to report on the state of the Union, but the events of earlier today have led me to change those plans. Today is a day for mourning and remembering. Nancy and I are pained to the core by the tragedy of the shuttle *Challenger*. We know we share this pain with all of the people of our country. This is truly a national loss.

Nineteen years ago, almost to the day, we lost three astronauts in a terrible accident on the ground. But we've never lost an astronaut in flight; we've never had a tragedy like this. And perhaps we've forgotten the courage it took for the crew of the shuttle. But they, the *Challenger* Seven, were aware of the dangers, but overcame them and did their jobs brilliantly. We mourn seven heroes: Michael Smith, Dick Scobee, Judith Resnik, Ronald McNair, Ellison Onizuka, Gregory Jarvis, and Christa McAuliffe. We mourn their loss as a nation together.

For the families of the seven, we cannot bear, as you do, the full impact of this tragedy. But we feel the loss, and we're thinking about you so very much. Your loved ones were daring and brave, and they had that special **grace**, that special spirit that says, "Give me a challenge, and I'll meet it with joy." They had a hunger to explore the universe and discover its truths. They wished to serve, and they did. They served all of us. We've grown used to wonders in this century. It's hard to dazzle us. But for 25 years the United States space program has been doing just that. We've grown used to the idea of space, and perhaps we forget that we've only just begun. We're still pioneers. They, the members of the *Challenger* crew, were pioneers.

And I want to say something to the schoolchildren of America who were watching the live coverage of the shuttle's takeoff. I know it is hard to understand, but sometimes painful things like this happen. It's all part of the process of exploration and discovery. It's all part of taking a chance and expanding man's **horizons**. The future doesn't belong to the fainthearted; it belongs to the brave. The *Challenger* crew was pulling us into the future, and we'll continue to follow them.

I've always had great faith in and respect for our space program, and what happened today does nothing to diminish it. We don't hide our space program. We don't keep secrets and cover things up. We do it all up front and in public. That's the way freedom is, and we wouldn't change it for a minute. We'll continue our quest in space. There will be more shuttle flights and more shuttle crews and, yes, more volunteers, more civilians, more teachers in space. Nothing ends here; our hopes and our journeys continue. I want to add that I wish I could talk to every man and woman who works for NASA or who worked on this mission and tell them: "Your dedication and **professionalism** have moved and impressed us for decades. And we know

of your **anguish**. We share it.”

There’s a **coincidence** today. On this day 390 years ago, the great explorer Sir Francis Drake died aboard ship off the coast of Panama. In his lifetime the great frontiers were the oceans, and an historian later said, “He lived by the sea, died on it, and was buried in it.” Well, today we can say of the *Challenger* crew: Their dedication was, like Drake’s, complete.

The crew of the space shuttle *Challenger* honored us by the manner in which they lived their lives. We will never forget them, nor the last time we saw them, this morning, as they prepared for their journey and waved goodbye and “slipped the surly bonds of earth” to “touch the face of God.”

Annotations

First Read: Address to Students at Moscow State University

Read

As you know, I've come to Moscow to meet with one of your most distinguished graduates. In this, our fourth summit, General Secretary Gorbachev and I have spent many hours together, and I feel that we're getting to know each other well. Our discussions, of course, have been focused primarily on many of the important issues of the day, issues I want to touch on with you in a few moments. But first I want to take a little time to talk to you much as I would to any group of university students in the United States. I want to talk not just of the realities of today but of the possibilities of tomorrow.

Standing here before a mural of your revolution, I want to talk about a very different revolution that is taking place right now, quietly sweeping the globe without bloodshed or conflict. Its effects are peaceful, but they will **fundamentally** alter our world, shatter old assumptions, and reshape our lives. It's easy to underestimate because it's not accompanied by banners or fanfare. It's been called the technological or information revolution, and as its emblem, one might take the tiny silicon chip, no bigger than a fingerprint. One of these chips has more computing power than a roomful of old-style computers.

As part of an exchange program, we now have an **exhibition** touring your country that shows how information technology is transforming our lives -- replacing manual labor with robots, forecasting weather for farmers, or mapping the genetic code of DNA for medical researchers. These microcomputers today aid the design of everything from houses to cars to spacecraft; they even design better and faster computers. They can translate English into Russian or enable the blind to read or help Michael Jackson produce on one synthesizer the sounds of a whole orchestra. Linked by a network of satellites and fiber-optic cables, one individual with a desktop computer and a telephone commands resources unavailable to the largest governments just a few years ago.

Like a chrysalis, we're emerging from the economy of the Industrial Revolution -- an economy confined to and limited by the Earth's physical resources -- into, as one economist titled his book, "The Economy in Mind," in which there are no bounds on human imagination and the freedom to create is the most precious natural resource. Think of that little computer chip. Its value isn't in the sand from which it is made but in the microscopic architecture designed into it by ingenious human minds. Or take the example of the satellite relaying this broadcast around the world, which replaces thousands of tons of copper mined from the Earth and molded into wire. In the new economy, human invention increasingly makes physical resources obsolete. We're breaking through the material conditions of existence to a world where man creates his own destiny. Even as we explore the most advanced reaches of science, we're returning to the age-old wisdom of our culture, a wisdom contained in the book of Genesis in the Bible: In the beginning was the spirit and it was from this spirit that the material abundance of creation issued forth.

But progress is not **foreordained**. The key is freedom -- freedom of thought, freedom of information,

freedom of communication. The renowned scientist, scholar, and founding father of this university, Mikhail Lomonosov, knew that. "It is common knowledge," he said, "that the achievements of science are considerable and rapid, particularly once the yoke of slavery is cast off and replaced by the freedom of philosophy."

You know, one of the first contacts between your country and mine took place between Russian and American explorers. The Americans were members of Cook's last voyage on an expedition searching for an Arctic passage; on the island of Unalaska, they came upon the Russians, who took them in, and together with the native inhabitants, held a prayer service on the ice.

The explorers of the modern era are the entrepreneurs, men with vision, with the courage to take risks and faith enough to brave the unknown. These entrepreneurs and their small enterprises are responsible for almost all the economic growth in the United States. They are the prime movers of the technological revolution. In fact, one of the largest personal computer firms in the United States was started by two college students, no older than you, in the garage behind their home. Some people, even in my own country, look at the riot of experiment that is the free market and see only waste. What of all the entrepreneurs that fail? Well, many do, particularly the successful ones; often several times. And if you ask them the secret of their success they'll tell you it's all that they learned in their struggles along the way; yes, it's what they learned from failing. Like an athlete in competition or a scholar in pursuit of the truth, experience is the greatest teacher.

And that's why it's so hard for government planners, no matter how sophisticated, to ever substitute for millions of individuals working night and day to make their dreams come true.

...

We Americans make no secret of our belief in freedom. In fact, it's something of a national pastime. Every 4 years the American people choose a new President, and 1988 is one of those years. At one point there were 13 major candidates running in the two major parties, not to mention all the others, including the Socialist and Libertarian candidates -- all trying to get my job.

About 1,000 local television stations, 8,500 radio stations, and 1,700 daily newspapers -- each one an independent, private enterprise, fiercely independent of the Government -- report on the candidates, grill them in interviews, and bring them together for debates. In the end, the people vote; they decide who will be the next President.

But freedom doesn't begin or end with elections. Go to any American town, to take just an example, and you'll see dozens of churches, representing many different beliefs -- in many places, synagogues and mosques -- and you'll see families of every conceivable nationality worshiping together. Go into any schoolroom, and there you will see children being taught the Declaration of Independence, that they are endowed by their Creator with certain unalienable rights -- among them life, liberty, and the pursuit of happiness -- that no government can justly deny; the guarantees in their Constitution for freedom of

speech, freedom of assembly, and freedom of religion.

Go into any courtroom, and there will preside an independent judge, **beholden** to no government power. There every defendant has the right to a trial by a jury of his peers, usually 12 men and women -- common citizens; they are the ones, the only ones, who weigh the evidence and decide on guilt or innocence. In that court, the accused is innocent until proven guilty, and the word of a policeman or any official has no greater legal standing than the word of the accused.

Go to any university campus, and there you'll find an open, sometimes heated discussion of the problems in American society and what can be done to correct them. Turn on the television, and you'll see the legislature conducting the business of government right there before the camera, debating and voting on the legislation that will become the law of the land. March in any demonstration, and there are many of them; the people's right of assembly is guaranteed in the Constitution and protected by the police. Go into any union hall, where the members know their right to strike is protected by law. As a matter of fact, one of the many jobs I had before this one was being president of a union, the Screen Actors Guild. I led my union out on strike, and I'm proud to say we won.

But freedom is more even than this. Freedom is the right to question and change the established way of doing things. It is the continuing revolution of the marketplace. It is the understanding that allows us to recognize shortcomings and seek solutions. It is the right to put forth an idea, scoffed at by the experts, and watch it catch fire among the people. It is the right to dream -- to follow your dream or stick to your conscience, even if you're the only one in a sea of doubters. Freedom is the recognition that no single person, no single authority or government has a monopoly on the truth, but that every individual life is infinitely precious, that every one of us put on this world has been put there for a reason and has something to offer.

...

But I hope you know I go on about these things not simply to **extol** the virtues of my own country but to speak to the true greatness of the heart and soul of your land. Who, after all, needs to tell the land of Dostoyevski about the quest for truth, the home of Kandinski and Scriabin about imagination, the rich and noble culture of the Uzbek man of letters Alisher Navoi about beauty and heart? The great culture of your diverse land speaks with a glowing passion to all humanity. Let me cite one of the most eloquent contemporary passages on human freedom. It comes, not from the literature of America, but from this country, from one of the greatest writers of the 20th century, Boris Pasternak, in the novel "Dr. Zhivago." He writes: "I think that if the beast who sleeps in man could be held down by threats -- any kind of threat, whether of jail or of retribution after death -- then the highest emblem of humanity would be the lion tamer in the circus with his whip, not the prophet who sacrificed himself. But this is just the point -- what has for centuries raised man above the beast is not the cudgel, but an inward music -- the irresistible power of unarmed truth."

Annotations
