

Lesson 9

This lesson covers pages 163-192 in the text, and will focus on the limited third-person narrator and its effects on setting and plot. Watch the operation of the narrative voice in Tom Godwin's *The Cold Equations* (pages 164-183), and consider how the choice of limited third-person narrator helps enhance suspense and allows the author to control when and how information is revealed to the reader. Think about how the choice of narrator reflects the intensity of the story's setting. Pay attention also to the use of specialized language, or jargon, which is common in genres like science fiction. Look at the contrasting vision of technology in Richard Brautigan's poem *All Watched Over by Machines of Loving Grace* on page 184.

Read page 186 to study using a thesaurus and subject-verb agreement. Then read the article *Taste – the Final Frontier* by Esther Addley (pages 188-190) and think of relevant research questions for further study of the topic. Finally, study semantic maps on page 192.

English 10

Lesson 9

BEFORE YOU READ



The Cold Equations

Make the Connection

Quickwrite

Nobody gets through life without having to make hard decisions. What kinds of choices might have difficult consequences no matter what we decide to do? Freewrite about such a choice. How would you make a decision when faced with such a hard choice?

Literary Focus

Third-Person-Limited Point of View

Like the omniscient narrator, the narrator of a story written from the **third-person-limited point of view** stands outside the action and refers to all the characters by name or as *he* or *she*. Unlike the omniscient narrator, however, this narrator zooms in on the thoughts, actions, and feelings of only *one* character. We almost never know what the others are thinking.



This point of view is popular with modern writers because it combines the possibilities of the omniscient point of view with the intense, personal focus of first-person narration. In “The Cold Equations” the third-person-limited narrator provides a calm voice in an increasingly tense, emotional situation.

Reading Skills

Monitoring Your Reading: Questioning

Good readers ask questions as they read — whether they’re reading a detective story or a serious novel. As you read “The Cold Equations,” answer the questions at the open-book signs. They will serve as a guide for you to ask additional questions of your own as you read. You may keep wondering what is going to happen next in this suspenseful tale. You may have questions about the characters and the unusual setting and circumstances or about the choice of narrator. You may even have questions about Godwin’s use of science.

The Cold Equations

Tom Godwin




He was not alone.

There was nothing to indicate the fact but the white hand of the tiny gauge on the board before him. The control room was empty but for himself; there was no sound other than the murmur of the drives — but the white hand had moved. It had been on zero when the little ship was launched from the *Stardust*; now, an hour later, it had crept up. There was something in the supply closet across the room, it was saying, some kind of a body that radiated heat.

It could be but one kind of a body — a living, human body.

He leaned back in the pilot’s chair and drew a deep, slow breath, considering what he would have to do. He was an EDS pilot, **inured** to the sight of death, long since accustomed to it and to viewing the dying of another man with an objective lack of emotion, and he had no choice in what he must do. There could be no alternative — but it required a few moments of conditioning for even an EDS pilot to prepare himself to walk across the room and coldly, deliberately, take the life of a man he had yet to meet.

He would, of course, do it. It was the law, stated very bluntly and definitely in grim Paragraph L, Section 8, of Interstellar Regulations: “*Any stowaway discovered in an EDS shall be jettisoned immediately following discovery.*”

It was the law, and there could be no appeal. 



It was a law not of men’s choosing but made imperative by the circumstances of the space frontier. Galactic expansion had followed the development of the hyperspace drive, and as men scattered wide across the frontier, there had come the problem of contact with the isolated first colonies and exploration parties. The huge hyperspace cruisers were the product of the combined genius and effort of Earth and were long and expensive in the building. They were not available in such numbers that small colonies could possess them. The cruisers carried the colonists to their new worlds and made periodic visits, running on tight schedules, but they could not stop and turn aside to visit colonies scheduled to be visited at another time; such a delay would destroy their schedule and produce a confusion and uncertainty that would wreck the complex interdependence between old Earth and the new worlds of the frontier.

Some method of delivering supplies or assistance when an emergency occurred on a world not scheduled for a visit had been needed, and the Emergency Dispatch Ships had been the answer. Small and collapsible, they occupied little room in the hold of the cruiser; made of light metal and plastics, they were driven by a small rocket drive that consumed relatively little fuel. Each cruiser carried four EDSs, and when a call for aid was received, the nearest cruiser would drop into normal space long enough to launch an EDS with the needed supplies or personnel, then vanish again as it continued on its course.

The cruisers, powered by nuclear converters, did not use the liquid rocket fuel, but nuclear converters were

far too large and complex to permit their installation in the EDSs. The cruisers were forced by necessity to carry a limited amount of bulky rocket fuel, and the fuel was rationed with care, the cruiser's computers determining the exact amount of fuel each EDS would require for its mission. The computers considered the course coordinates, the mass of the EDS, the mass of pilot and cargo; they were very precise and accurate and omitted nothing from their calculations. They could not, however, foresee and allow for the added mass of a stowaway. 🚀 2

🔊 The *Stardust* had received the request from one of the exploration parties stationed on Woden, the six men of the party already being stricken with the fever carried by the green kala midges and their own supply of serum destroyed by the tornado that had torn through their camp. The *Stardust* had gone through the usual procedure, dropping into normal space to launch the EDS with the fever serum, then vanishing again in hyperspace. Now, an hour later, the gauge was saying there was something more than the small carton of serum in the supply closet.

🔊 He let his eyes rest on the narrow white door of the closet. There, just inside, another man lived and breathed and was beginning to feel assured that discovery of his presence would now be too late for the pilot to alter the situation. It *was* too late; for the man behind the door it was far later than he thought and in a way he would find it terrible to believe.

There could be no alternative. Additional fuel would be used during the hours of deceleration to compensate for the added mass of the stowaway, infinitesimal **increments** of fuel that would not be missed until the ship had almost reached its destination. Then, at some distance above the ground that might be as near as a thousand feet or as far as tens of thousands of feet, depending upon the mass of ship and cargo and the preceding period of deceleration, the unmissed increments of fuel would make their absence known; the EDS would expend its last drops of fuel with a sputter and go into whistling free fall. Ship and pilot and stowaway would merge together upon impact as a wreckage of metal and plastic, flesh and blood, driven deep into the soil. The stowaway had signed his own death warrant when he concealed himself on the ship; he could not be permitted to take seven others with him.

He looked again at the telltale white hand, then rose to his feet. What he must do would be unpleasant for both of them; the sooner it was over, the better. He stepped across the control room to stand by the white door.

🔊 “Come out!” His command was harsh and abrupt above the murmur of the drive.

It seemed he could hear the whisper of a furtive movement inside the closet, then nothing. He visualized the stowaway cowering closer into one corner, suddenly worried by the possible consequences of his act, his self-assurance evaporating.


“I said *out!*”


He heard the stowaway move to obey, and he waited with his eyes alert on the door and his hand near the blaster at his side.

The door opened and the stowaway stepped through it, smiling. “All right — I give up. Now what?”

It was a girl.

He stared without speaking, his hand dropping away from the blaster, and acceptance of what he saw coming like a heavy and unexpected physical blow. The stowaway was not a man — she was a girl in her teens, standing before him in little white gypsy sandals, with the top of her brown, curly head hardly higher than his shoulder, with a faint, sweet scent of perfume coming from her, and her smiling face tilted up so her eyes

could look unknowing and unafraid into his as she waited for his answer.  3

 *Now what?* Had it been asked in the deep, defiant voice of a man, he would have answered it with action, quick and efficient. He would have taken the stowaway's identification disk and ordered him into the air lock. Had the stowaway refused to obey, he would have used the blaster. It would not have taken long; within a minute the body would have been ejected into space — had the stowaway been a man.

He returned to the pilot's chair and motioned her to seat herself on the boxlike bulk of the drive-control units that were set against the wall beside him. She obeyed, his silence making the smile fade into the meek and guilty expression of a pup that has been caught in mischief and knows it must be punished.


"You still haven't told me," she said. "I'm guilty, so what happens to me now? Do I pay a fine, or what?"

"What are you doing here?" he asked. "Why did you stow away on this EDS?"

"I wanted to see my brother. He's with the government survey crew on Woden and I haven't seen him for ten years, not since he left Earth to go into government survey work."

"What was your destination on the *Stardust*?"

"Mimir. I have a position waiting for me there. My brother has been sending money home all the time to us — my father and mother and me — and he paid for a special course in linguistics I was taking. I graduated sooner than expected and I was offered this job in Mimir. I knew it would be almost a year before Gerry's job was done on Woden so he could come on to Mimir, and that's why I hid in the closet there. There was plenty of room for me and I was willing to pay the fine. There were only the two of us kids — Gerry and I — and I haven't seen him for so long, and I didn't want to wait another year when I could see him now, even though I knew I would be breaking some kind of a regulation when I did it."

 *I knew I would be breaking some kind of a regulation.* In a way, she could not be blamed for her ignorance of the law; she was of Earth and had not realized that the laws of the space frontier must, of necessity, be as hard and relentless as the environment that gave them birth. Yet, to protect such as her from the results of their own ignorance of the frontier, there had been a sign over the door that led to the section of the *Stardust* that housed the EDSs, a sign that was plain for all to see and heed: UNAUTHORIZED PERSONNEL KEEP OUT!

"Does your brother know that you took passage on the *Stardust* for Mimir?"

"Oh, yes. I sent him a spacegram telling him about my graduation and about going to Mimir on the *Stardust* a month before I left Earth. I already knew Mimir was where he would be stationed in a little over a year. He gets a promotion then, and he'll be based on Mimir and not have to stay out a year at a time on field trips, like he does now."


There were two different survey groups on Woden, and he asked, "What is his name?"

"Cross — Gerry Cross. He's in Group Two — that was the way his address read. Do you know him?"

Group One had requested the serum: Group Two was eight thousand miles away, across the Western Sea.

"No, I've never met him," he said, then turned to the control board and cut the deceleration to a fraction of a gravity, knowing as he did so that it could not avert the ultimate end, yet doing the only thing he could do to prolong that ultimate end. The sensation was like that of the ship suddenly dropping, and the girls involuntary movement of surprise half lifted her from her seat.

“We’re going faster now, aren’t we?” she asked. “Why are we doing that?”

 He told her the truth. “To save fuel for a little while.”

“You mean we don’t have very much?”

He delayed the answer he must give her so soon to ask, “How did you manage to stow away?”


“I just sort of walked in when no one was looking my way,” she said. “I was practicing my Gelanese on the native girl who does the cleaning in the Ship’s Supply office when someone came in with an order for supplies for the survey crew on Woden. I slipped into the closet there after the ship was ready to go just before you came in. It was an impulse of the moment to stow away, so I could get to see Gerry — and from the way you keep looking at me so grim, I’m not sure it was a very wise impulse. But I’ll be a model criminal — or do I mean prisoner?” She smiled at him again. “I intended to pay for my keep on top of paying the fine. I can cook and I can patch clothes for everyone and I know how to do all kinds of useful things, even a little bit about nursing.”


There was one more question to ask:

“Did you know what the supplies were that the survey crew ordered?”

“Why, no. Equipment they needed in their work, I supposed.”

Why couldn’t she have been a man with some ulterior motive? A fugitive from justice hoping to lose himself on a raw new world; an opportunist seeking transportation to the new colonies where he might find golden fleece for the taking; a crackpot with a mission. Perhaps once in his lifetime an EDS pilot would find such a stowaway on his ship — warped men, mean and selfish men, brutal and dangerous men — but never before a smiling, blue-eyed girl who was willing to pay her fine and work for her keep that she might see her brother.

He turned to the board and turned the switch that would signal the *Stardust*. The call would be futile, but he could not, until he had exhausted that one vain hope, seize her and thrust her into the air lock as he would an animal — or a man. The delay, in the meantime, would not be dangerous with the EDS decelerating at fractional gravity. 

 A voice spoke from the communicator. “*Stardust*. Identify yourself and proceed.”

“Barton, EDS 34GII. Emergency. Give me Commander Delhart.”

There was a faint confusion of noises as the request went through the proper channels. The girl was watching him, no longer smiling.

“Are you going to order them to come back after me?” she asked.

The communicator clicked and there was the sound of a distant voice saying, “Commander, the EDS requests...”

“Are they coming back after me?” she asked again. “Won’t I get to see my brother after all?”

“Barton?” The blunt, gruff voice of Commander Delhart came from the communicator. “What’s this about an emergency?”

“A stowaway,” he answered.

“A stowaway?” There was a slight surprise to the question. “That’s rather unusual — but why the ‘emergency’ call? You discovered him in time, so there should be no appreciable danger, and I presume you’ve informed Ship’s Records so his nearest relatives can be notified.”

“That’s why I had to call you, first. The stowaway is still aboard and the circumstances are so different—”

“Different?” the commander interrupted, impatience in his voice. “How can they be different? You know you have a limited supply of fuel; you also know the law as well as I do: ‘Any stowaway discovered in an EDS shall be jettisoned immediately following discovery.’”


There was the sound of a sharply indrawn breath from the girl. “*What does he mean?*”

“The stowaway is a girl.”

“*What?*”

“She wanted to see her brother. She’s only a kid and she didn’t know what she was really doing.”

“I see.” All the curtness was gone from the commander’s voice. “So you called me in the hope I could do something?” Without waiting for an answer he went on, “I’m sorry — I can do nothing. This cruiser must maintain its schedule; the life of not one person but the lives of many depend on it. I know how you feel but I’m powerless to help you. You’ll have to go through with it. I’ll have you connected with Ship’s Records.”

 The communicator faded to a faint rustle of sound, and he turned back to the girl. She was leaning forward on the bench, almost rigid, her eyes fixed wide and frightened.

“What did he mean, to go through with it? To jettison me... to go through with it — what did he mean? Not the way it sounded... he couldn’t have. What did he mean — what did he really mean?”


Her time was too short for the comfort of a lie to be more than a cruelly fleeting delusion.

“He meant it the way it sounded.”

“*No!*” She **recoiled** from him as though he had struck her, one hand half raised as though to fend him off and stark unwillingness to believe in her eyes.

“It will have to be.”

“No! You’re joking — you’re insane! You can’t mean it!”

 “I’m sorry.” He spoke slowly to her, gently. “I should have told you before — I should have, but I had to do what I could first; I had to call the *Stardust*. You heard what the commander said.”

“But you can’t — if you make me leave the ship, I’ll *die*.”  5

 “I know.”

She searched his face, and the unwillingness to believe left her eyes, giving way slowly to a look of dazed horror.

“You know?” She spoke the words far apart, numbly and wonderingly.

“I know. It has to be like that.”

“You mean it — you really mean it.” She sagged back against the wall, small and limp like a little rag doll, and all the protesting and disbelief gone. “You’re going to do it — you’re going to make me die?”

“I’m sorry,” he said again. “You’ll never know how sorry I am. It has to be that way and no human in the universe can change it.”

“You’re going to make me die and I didn’t do anything to die for — I didn’t *do* anything—”

He sighed, deep and weary. “I know you didn’t, child. I know you didn’t.”

“EDS.” The communicator rapped brisk and metallic. “This is Ship’s Records. Give us all information on subject’s identification disk.”

He got out of his chair to stand over her. She clutched the edge of the seat, her upturned face white under the brown hair and the lipstick standing out like a blood-red cupid's bow.

“*Now?*”

“I want your identification disk,” he said.

She released the edge of the seat and fumbled at the chain that suspended the plastic disk from her neck with fingers that were trembling and awkward. He reached down and unfastened the clasp for her, then returned with the disk to his chair.

“Here’s your data, Records: Identification Number T837—”

“One moment,” Records interrupted. “This is to be filed on the gray card, of course?”

“Yes.”


“And the time of execution?”

“I’ll tell you later.”

“Later? This is highly irregular; the time of the subject’s death is required before—”

He kept the thickness out of his voice with an effort. “Then we’ll do it in a highly irregular manner — you’ll hear the disk read first. The subject is a girl and she’s listening to everything that’s said. Are you capable of understanding that?”


There was a brief, almost shocked silence; then Records said meekly, “Sorry. Go ahead.”

 He began to read the disk, reading it slowly to delay the inevitable for as long as possible, trying to help her by giving her what little time he could to recover from her first horror and let it resolve into the calm of acceptance and resignation.

“Number T8374 dash Y54. Name, Marilyn Lee Cross. Sex, female. Born July 7, 2160.” *She was only eighteen.* “Height, five-three. Weight, a hundred and ten.” *Such a slight weight, yet enough to add fatally to the mass of the shell-thin bubble that was an EDS.* “Hair, brown. Eyes, blue. Complexion, light. Blood type O.” *Irrelevant data.* “Destination, Port City, Mimir.” *Invalid data.*

He finished and said, “I’ll call you later,” then turned once again to the girl. She was huddled back against the wall, watching him with a look of numb and wondering fascination.

“They’re waiting for you to kill me, aren’t they? They want me dead, don’t they? You and everybody on the cruiser want me dead, don’t you?” Then the numbness broke and her voice was that of a frightened and bewildered child. “Everybody wants me dead and I didn’t *do* anything. I didn’t hurt anyone — I only wanted to see my brother.”

 “It’s not the way you think — it isn’t that way at all,” he said. “Nobody wants it this way; nobody would ever let it be this way if it was humanly possible to change it.”

“Then why is it? I don’t understand. Why is it?”

“This ship is carrying kala fever serum to Group One on Woden. Their own supply was destroyed by a tornado. Group Two — the crew your brother is in — is eight thousand miles away across the Western Sea, and their helicopters can’t cross it to help Group One. The fever is invariably fatal unless the serum can be had in time, and the six men in Group One will die unless this ship reaches them on schedule. These little ships are always given barely enough fuel to reach their destination, and if you stay aboard, your added weight will cause it to use up all its fuel before it reaches the ground. It will crash then, and you and I will die and so will the six men waiting for the fever serum.”

It was a full minute before she spoke, and as she considered his words, the expression of numbness left her eyes.

“Is that it?” she asked at last. “Just that the ship doesn’t have enough fuel?”

“Yes.”

“I can go alone or I can take seven others with me — is that the way it is?”

“That’s the way it is.”

“And nobody wants me to have to die?”

“Nobody.”

“Then maybe — Are you sure nothing can be done about it? Wouldn’t people help me if they could?”

“Everyone would like to help you, but there is nothing anyone can do. I did the only thing I could do when I called the *Stardust*.”

“And it won’t come back — but there might be other cruisers, mightn’t there? Isn’t there any hope at all that there might be someone, somewhere, who could do something to help me?”

She was leaning forward a little in her eagerness as she waited for his answer.

“No.”

The word was like the drop of a cold stone and she again leaned back against the wall, the hope and eagerness leaving her face. “You’re sure — you *know* you’re sure?”

“I’m sure. There are no other cruisers within forty light-years; there is nothing and no one to change things.”

She dropped her gaze to her lap and began twisting a pleat of her skirt between her fingers, saying no more as her mind began to adapt itself to the grim knowledge.




— It was better so; with the going of all hope would go the fear; with the going of all hope would come resignation. She needed time and she could have so little of it. How much?

The EDSs were not equipped with hull-cooling units; their speed had to be reduced to a moderate level before they entered the atmosphere. They were decelerating at .10 gravity, approaching their destination at a far higher speed than the computers had calculated on. The *Stardust* had been quite near Woden when she launched the EDS; their present velocity was putting them nearer by the second. There would be a critical point, soon to be reached, when he would have to resume deceleration. When he did so, the girl's weight would be multiplied by the gravities of deceleration, would become, suddenly, a factor of **paramount** importance, the factor the computers had been ignorant of when they determined the amount of fuel the EDS should have. She would have to go when deceleration began; it could be no other way. When would that be — how long could he let her stay?

“How long can I stay?”

He winced involuntarily from the words that were so like an echo of his own thoughts. How long? He didn't know; he would have to ask the ship's computers. Each EDS was given a meager surplus of fuel to compensate for unfavorable conditions within the atmosphere, and relatively little fuel was being consumed for the time being. The memory banks of the computers would still contain all data pertaining to the course set for the EDS; such data would not be erased until the EDS reached its destination. He had only to give the computers the new data — the girl's weight and the exact time at which he had reduced the deceleration to .10.

 “Barton.” Commander Delhart's voice came abruptly from the communicator as he opened his mouth to call the *Stardust*. “A check with Records shows me you haven't completed your report. Did you reduce the deceleration?”

So the commander knew what he was trying to do.

“I'm decelerating at point ten,” he answered. “I cut the deceleration at seventeen fifty and the weight is a hundred and ten. I would like to stay at point ten as long as the computers say I can. Will you give them the question?”

It was contrary to regulations for an EDS pilot to make any changes in the course or degree of deceleration the computers had set for him, but the commander made no mention of the violation. Neither did he ask the reason for it. It was not necessary for him to ask; he had not become commander of an interstellar cruiser without both intelligence and an understanding of human nature. He said only, “I'll have that given to the computers.”

The communicator fell silent and he and the girl waited, neither of them speaking. They would not have to wait long; the computers would give the answer within moments of the asking. The new factors would be fed into the steel maw of the first bank, and the electrical impulses would go through the complex circuits. Here and there a relay might click, a tiny cog turn over, but it would be essentially the electrical impulses that found the answer; formless, mindless, invisible, determining with utter precision how long the pale girl beside him might live. Then five little segments of metal in the second bank would trip in rapid succession against an inked ribbon and a second steel maw would spit out the slip of paper that bore the answer.



 The chronometer on the instrument board read 18:10 when the commander spoke again.


“You will resume deceleration at nineteen ten.”

She looked toward the chronometer, then quickly away from it. “Is that when... when I go?” she asked. He nodded and she dropped her eyes to her lap again.

“I’ll have the course correction given to you,” the commander said. “Ordinarily I would never permit anything like this, but I understand your position. There is nothing I can do, other than what I’ve just done, and you will not deviate from these new instructions. You will complete your report at nineteen ten. Now — here are the course corrections.”

The voice of some unknown technician read them to him, and he wrote them down on the pad clipped to the edge of the control board. There would, he saw, be periods of deceleration when he neared the atmosphere when the deceleration would be five gravities — and at five gravities, one hundred ten pounds would become five hundred fifty pounds.

The technician finished and he terminated the contact with a brief acknowledgment. Then, hesitating a moment, he reached out and shut off the communicator. It was 18:13 and he would have nothing to report until 19:10. In the meantime, it somehow seemed indecent to permit others to hear what she might say in her last hour.

 He began to check the instrument readings, going over them with unnecessary slowness. She would have to accept the circumstances, and there was nothing he could do to help her into acceptance; words of sympathy would only delay it.

It was 18:20 when she stirred from her motionlessness and spoke.


“So that’s the way it has to be with me?”


He swung around to face her. “You understand now, don’t you? No one would ever let it be like this if it could be changed.”

“I understand,” she said. Some of the color had returned to her face and the lipstick no longer stood out so vividly red. “There isn’t enough fuel for me to stay. When I hid on this ship, I got into something I didn’t know anything about and now I have to pay for it.”

She had violated a man-made law that said KEEP OUT, but the penalty was not for men’s making or desire and it was a penalty men could not revoke. A physical law had decreed: *h amount of fuel will power an EDS with a mass of m safely to its destination*; and a second physical law had decreed: *h amount of fuel will not power an EDS with a mass of m plus x safely to its destination*.

EDSs obeyed only physical laws, and no amount of human sympathy for her could alter the second law.

“But I’m afraid. I don’t want to die — not now. I want to live, and nobody is doing anything to help me; everybody is letting me go ahead and acting just like nothing was going to happen to me. I’m going to die and nobody *cares*.” 

 “We all do,” he said. “I do and the commander does and the clerk in Ship’s Records; we all care and each of us did what little he could to help you. It wasn’t enough — it was almost nothing — but it was all we could do.”


“Not enough fuel — I can understand that,” she said, as though she had not heard his own words. “But to have to die for it. *Me* alone...”

How hard it must be for her to accept the fact. She had never known danger of death, had never known the environments where the lives of men could be as fragile and fleeting as sea foam tossed against a rocky

shore. She belonged on gentle Earth, in that secure and peaceful society where she could be young and gay and laughing with the others of her kind, where life was precious and well guarded and there was always the assurance that tomorrow would come. She belonged in that world of soft winds and a warm sun, music and moonlight and gracious manners, and not on the hard, bleak frontier.

“How did it happen to me so terribly quickly? An hour ago I was on the *Stardust*, going to Mimir. Now the *Stardust* is going on without me and I’m going to die and I’ll never see Gerry and Mama and Daddy again — I’ll never see anything again.”

He hesitated, wondering how he could explain it to her so she would really understand and not feel she had somehow been the victim of a reasonlessly cruel injustice. She did not know what the frontier was like; she thought in terms of safe, secure Earth. Pretty girls were not jettisoned on Earth; there was a law against it. On Earth her plight would have filled the newscasts and a fast black patrol ship would have been racing to her rescue. Everyone, everywhere, would have known of Marilyn Lee Cross, and no effort would have been spared to save her life. But this was not Earth and there were no patrol ships; only the *Stardust*, leaving them behind at many times the speed of light. There was no one to help her; there would be no Marilyn Lee Cross smiling from the newscasts tomorrow. Marilyn Lee Cross would be but a poignant memory for an EDS pilot and a name on a gray card in Ship’s Records.


 “It’s different here; it’s not like back on Earth,” he said. “It isn’t that no one cares; it’s that no one can do anything to help. The frontier is big, and here along its rim the colonies and exploration parties are scattered so thin and far between. On Woden, for example, there are only sixteen men — sixteen men on an entire world. The exploration parties, the survey crews, the little first colonies — they’re all fighting alien environments, trying to make a way for those who will follow after. The environments fight back, and those who go first usually make mistakes only once. There is no margin of safety along the rim of the frontier; there can’t be until the way is made for the others who will come later, until the new worlds are tamed and settled. Until then men will have to pay the penalty for making mistakes, with no one to help them, because there is no one *to* help them.”

“I was going to Mimir,” she said. “I didn’t know about the frontier; I was only going to Mimir and *it’s* safe.”

“Mimir is safe, but you left the cruiser that was taking you there.”

She was silent for a little while. “It was all so wonderful at first; there was plenty of room for me on this ship and I would be seeing Gerry so soon. I didn’t know about the fuel, didn’t know what would happen to me...”


Her words trailed away, and he turned his attention to the viewscreen, not wanting to stare at her as she fought her way through the black horror of fear toward the calm gray of acceptance.



 Woden was a ball, enshrouded in the blue haze of its atmosphere, swimming in space against the background of star-sprinkled dead blackness. The great mass of Manning’s Continent sprawled like a gigantic hourglass in the Eastern Sea, with the western half of the Eastern Continent still visible. There was a thin line of shadow along the right-hand edge of the globe, and the Eastern Continent was disappearing into it as the planet turned on its axis. An hour before, the entire continent had been in view; now a thousand miles of it had gone into the thin edge of shadow and around to the night that lay on the other side of the world. The dark blue spot that was Lotus Lake was approaching the shadow. It was somewhere near the southern edge of the lake that Group Two had their camp. It would be night there soon, and quick behind the coming of night the rotation of Woden on its axis would put Group Two beyond the reach of the ship’s radio.


He would have to tell her before it was too late for her to talk to her brother. In a way, it would be better for both of them should they not do so, but it was not for him to decide. To each of them the last words would be something to hold and cherish, something that would cut like the blade of a knife yet would be infinitely

precious to remember, she for her own brief moments to live and he for the rest of his life.

He held down the button that would flash the grid lines on the viewscreen and used the known diameter of the planet to estimate the distance the southern tip of Lotus Lake had yet to go until it passed beyond radio range. It was approximately five hundred miles. Five hundred miles; thirty minutes — and the chronometer read 18:30. Allowing for error in estimating, it would not be later than 19:05 that the turning of Woden would cut off her brother's voice.

 The first border of the Western continent was already in sight along the left side of the world. Four thousand miles across it lay the shore of the Western Sea and the camp of Group One. It had been in the Western Sea that the tornado had originated, to strike with such fury at the camp and destroy half their prefabricated buildings, including the one that housed the medical supplies. Two days before, the tornado had not existed; it had been no more than great gentle masses of air over the calm Western Sea. Group One had gone about their routine survey work, unaware of the meeting of air masses out at sea, unaware of the force the union was spawning. It had struck their camp without warning — a thundering, roaring destruction that sought to **annihilate** all that lay before it. It had passed on, leaving the wreckage in its wake. It had destroyed the labor of months and had doomed six men to die and then, as though its task was accomplished, it once more began to resolve into gentle masses of air. But, for all its deadliness, it had destroyed with neither malice nor intent. It had been a blind and mindless force, obeying the laws of nature, and it would have followed the same course with the same fury had men never existed.

 Existence required order, and there was order; the laws of nature, **irrevocable** and **immutable**. Men could learn to use them, but men could not change them. The circumference of a circle was always pi times the diameter, and no science of man would ever make it otherwise. The combination of chemical A with chemical B under condition C invariably produced reaction D. The law of gravitation was a rigid equation, and it made no distinction between the fall of a leaf and the **ponderous** circling of a binary star system. The nuclear conversion process powered the cruisers that carried men to the stars; the same process in the form of a nova would destroy a world with equal efficiency. The laws *were*, and the universe moved in obedience to them. Along the frontier were arrayed all the forces of nature, and sometimes they destroyed those who were fighting their way outward from Earth. The men of the frontier had long ago learned the bitter futility of cursing the forces that would destroy them, for the forces were blind and deaf; the futility of looking to the heavens for mercy, for the stars of the galaxy swung in their long, long sweep of two hundred million years, as inexorably controlled as they by the laws that knew neither hatred nor compassion. The men of the frontier knew — but how was a girl from Earth to fully understand? *h amount of fuel will not power an EDS with a mass of m plus x safely to its destination.* To him and her brother and parents she was a sweet-faced girl in her teens; to the laws of nature she was *x*, the unwanted factor in a cold equation.  8

 She stirred again on the seat. “Could I write a letter? I want to write to Mama and Daddy. And I’d like to talk to Gerry. Could you let me talk to him over your radio there?”

“I’ll try to get him,” he said.

He switched on the normal-space transmitter and pressed the signal button. Someone answered the buzzer almost immediately.


“Hello. How’s it going with you fellows now — is the EDS on its way?”

“This isn’t Group One; this is the EDS,” he said. “Is Gerry Cross there?”

“Gerry? He and two others went out in the helicopter this morning and aren’t back yet. It’s almost sundown, though, and he ought to be back right away — in less than an hour at the most.”

“Can you connect me through to the radio in his copter?”

“Huh-uh. It’s been out of commission for two months — some printed circuits went haywire and we can’t get any more until the next cruiser stops by. Is it something important — bad news for him, or something?”

 “Yes — it’s very important. When he comes in, get him to the transmitter as soon as you possibly can.”

“I’ll do that; I’ll have one of the boys waiting at the field with a truck. Is there anything else I can do?”

“No, I guess that’s all. Get him there as soon as you can and signal me.”


He turned the volume to an inaudible minimum, an act that would not affect the functioning of the signal buzzer, and unclipped the pad of paper from the control board. He tore off the sheet containing his flight instructions and handed the pad to her, together with pencil.

“I’d better write to Gerry too,” she said as she took them. “He might not get back to camp in time.”

She began to write, her fingers still clumsy and uncertain in the way they handled the pencil, and the top of it trembling a little as she poised it between words. He turned back to the viewscreen, to stare at it without seeing it.

She was a lonely little child trying to say her last goodbye, and she would lay out her heart to them. She would tell them how much she loved them and she would tell them to not feel bad about it, that it was only something that must happen eventually to everyone and she was not afraid. The last would be a lie and it would be there to read between the sprawling, uneven lines: a valiant little lie that would make the hurt all the greater for them.

Her brother was of the frontier and he would understand. He would not hate the EDS pilot for doing nothing to prevent her going; he would know there had been nothing the pilot could do. He would understand, though the understanding would not soften the shock and pain when he learned his sister was gone. But the others, her father and mother — they would not understand. They were of Earth and they would think in the manner of those who had never lived where the safety margin of life was a thin, thin line — and sometimes nothing at all. What would they think of the faceless, unknown pilot who had sent her to her death?

 They would hate him with cold and terrible intensity, but it really didn’t matter. He would never see them, never know them. He would have only the memories to remind him; only the nights of fear, when a blue-eyed girl in gypsy sandals would come in his dreams to die again...

He scowled at the viewscreen and tried to force his thoughts into less emotional channels. There was nothing he could do to help her. She had unknowingly subjected herself to the penalty of a law that recognized neither innocence nor youth nor beauty, that was incapable of sympathy or leniency. Regret was illogical — and yet, could knowing it to be illogical ever keep it away?

She stopped occasionally, as though trying to find the right words to tell them what she wanted them to know; then the pencil would resume its whispering to the paper. It was 18:37 when she folded the letter in a square and wrote a name on it. She began writing another, twice looking up at the chronometer, as though she feared the black hand might reach its rendezvous before she had finished. It was 18:45 when she folded it as she had done the first letter and wrote a name and address on it.

She held the letters out to him. “Will you take care of these and see that they’re enveloped and mailed?”

“Of course.” He took them from her hand and placed them in a pocket of his gray uniform shirt.


“These can’t be sent off until the next cruiser stops by, and the *Stardust* will have long since told them about me, won’t it?” she asked. He nodded and she went on: “That makes the letters not important in one way, but in another way they’re very important — to me, and to them.”

“I know. I understand, and I’ll take care of them.”

She glanced at the chronometer, then back to him. “It seems to move faster all the time, doesn’t it?”

He said nothing, unable to think of anything to say, and she asked, “Do you think Gerry will come back to camp in time?”

“I think so. They said he should be in right away.”

 She began to roll the pencil back and forth between her palms. “I hope he does. I feel sick and scared and I want to hear his voice again and maybe I won’t feel so alone. I’m a coward and I can’t help it.”

“No,” he said, “you’re not a coward. You’re afraid, but you’re not a coward.”

“Is there a difference?”

He nodded. “A lot of difference.”

“I feel so alone. I never did feel like this before; like I was all by myself and there was nobody to care what happened to me. Always, before, there were Mama and Daddy there and my friends around me. I had lots of friends, and they had a going-away party for me the night before I left.”

Friends and music and laughter for her to remember — and on the viewscreen Lotus Lake was going into the shadow.


“Is it the same with Gerry?” she asked. “I mean, if he should make a mistake, would he have to die for it, all alone and with no one to help him?”

“It’s the same with all, along the frontier; it will always be like that so long as there is a frontier.”

“Gerry didn’t tell us. He said the pay was good, and he sent money home all the time because Daddy’s little shop just brought in a bare living, but he didn’t tell us it was like this.”

“He didn’t tell you his work was dangerous?”

“Well — yes. He mentioned that, but we didn’t understand. I always thought danger along the frontier was something that was a lot of fun; an exciting adventure, like in the three-D shows.” A wan smile touched her face for a moment. “Only it’s not, is it? It’s not the same at all, because when it’s real you can’t go home after the show is over.”

 “No,” he said. “No, you can’t.”

Her glance flicked from the chronometer to the door of the air lock, then down to the pad and pencil she still held. She shifted her position slightly to lay them on the bench beside her, moving one foot out a little. For the first time he saw that she was not wearing Vegan gypsy sandals, but only cheap imitations; the expensive Vegan leather was some kind of grained plastic, the silver buckle was gilded iron, the jewels were colored glass. *Daddy’s little shop just brought in a bare living...* She must have left college in her second year, to take the course in linguistics that would enable her to make her own way and help her brother provide for her parents, earning what she could by part-time work after classes were over. Her personal possessions on the

Stardust would be taken back to her parents — they would neither be of much value nor occupy much storage space on the return voyage.

“Isn’t it—” She stopped, and he looked at her questioningly. “Isn’t it cold in here?” she asked, almost apologetically. “Doesn’t it seem cold to you?”

“Why, yes,” he said. He saw by the main temperature gauge that the room was at precisely normal temperature. “Yes, it’s colder than it should be.”


“I wish Gerry would get back before it’s too late. Do you really think he will, and you didn’t just say so to make me feel better?”

“I think he will — they said he would be in pretty soon.” On the viewscreen Lotus Lake had gone into the shadow but for the thin blue line of its western edge, and it was apparent he had overestimated the time she would have in which to talk to her brother. Reluctantly, he said to her, “His camp will be out of radio range in a few minutes; he’s on that part of Woden that’s in the shadow” — he indicated the viewscreen — “and the turning of Woden will put him beyond contact. There may not be much time left when he comes in — not much time to talk to him before he fades out. I wish I could do something about it — I would call him right now if I could.”

“Not even as much time as I will have to stay?”

“I’m afraid not.”

“Then—” She straightened and looked toward the air lock with pale resolution. “Then I’ll go when Gerry passes beyond range. I won’t wait any longer after that — I won’t have anything to wait for.”

 Again there was nothing he could say.


“Maybe I shouldn’t wait at all. Maybe I’m selfish — maybe it would be better for Gerry if you just told him about it afterward.”

There was an unconscious pleading for denial in the way she spoke and he said, “He wouldn’t want you to do that, to not wait for him.”

“It’s already coming dark where he is, isn’t it? There will be all the long night before him, and Mama and Daddy don’t know yet that I won’t ever be coming back like I promised them I would. I’ve caused everyone I love to be hurt, haven’t I? I didn’t want to — I didn’t intend to.”

“It wasn’t your fault,” he said. “It wasn’t your fault at all. They’ll know that. They’ll understand.”

“At first I was so afraid to die that I was a coward and thought only of myself. Now I see how selfish I was. The terrible thing about dying like this is not that I’ll be gone but that I’ll never see them again; never be able to tell them that I didn’t take them for granted; never be able to tell them I knew of the sacrifices they made to make my life happier, that I knew all the things they did for me and that I loved them so much more than I ever told them. I’ve never told them any of those things. You don’t tell them such things when you’re young and your life is all before you — you’re so afraid of sounding sentimental and silly. But it’s so different when you have to die — you wish you had told them while you could, and you wish you could tell them you’re sorry for all the little mean things you ever did or said to them. You wish you could tell them that you didn’t really mean to ever hurt their feelings and for them to only remember that you always loved them far more than you ever let them know.”


 “You don’t have to tell them that,” he said. “They will know — they’ve always known it.”

“Are you sure?” she asked. “How can you be sure? My people are strangers to you.”

“Wherever you go, human nature and human hearts are the same.”

“And they will know what I want them to know — that I love them?”

“They’ve always known it, in a way far better than you could ever put in words for them.”  9


 “I keep remembering the things they did for me, and it’s the little things they did that seem to be the most important to me, now. Like Gerry — he sent me a bracelet of fire rubies on my sixteenth birthday. It was beautiful — it must have cost him a month’s pay. Yet I remember him more for what he did the night my kitten got run over in the street. I was only six years old and he held me in his arms and wiped away my tears and told me not to cry, that Flossy was gone for just a little while, for just long enough to get herself a new fur coat, and she would be on the foot of my bed the very next morning. I believed him and quit crying and went to sleep dreaming about my kitten coming back. When I woke up the next morning, there was Flossy on the foot of my bed in a brand-new white fur coat, just like he had said she would be. It wasn’t until a long time later that Mama told me Gerry had got the pet-shop owner out of bed at four in the morning and, when the man got mad about it, Gerry told him he was either going to go down and sell him the white kitten right then or he’d break his neck.”

“It’s always the little things you remember people by, all the little things they did because they wanted to do them for you. You’ve done the same for Gerry and your father and mother; all kinds of things that you’ve forgotten about, but that they will never forget.”

“I hope I have. I would like for them to remember me like that.”

“They will.”

“I wish—” She swallowed. “The way I’ll die — I wish they wouldn’t ever think of that. I’ve read how people look who die in space — their insides all ruptured and exploded and their lungs out between their teeth and then, a few seconds later, they’re all dry and shapeless and horribly ugly. I don’t want them to ever think of me as something dead and horrible like that.”

 “You’re their own, their child and their sister. They could never think of you other than the way you would want them to, the way you looked the last time they saw you.”

“I’m still afraid,” she said. “I can’t help it, but I don’t want Gerry to know it. If he gets back in time, I’m going to act like I’m not afraid at all and—”

The signal buzzer interrupted her, quick and imperative.

“Gerry!” She came to her feet. “It’s Gerry now!”

He spun the volume control knob and asked, “Gerry Cross?”

“Yes,” her brother answered, an undertone of tenseness to his reply. “The bad news — what is it?”

She answered for him, standing close behind him and leaning down a little toward the communicator, her hand resting small and cold on his shoulder.

“Hello, Gerry.” There was only a faint quaver to betray the careful casualness of her voice. “I wanted to see you—”

“Marilyn!” There was sudden and terrible **apprehension** in the way he spoke her name. “What are you doing on that EDS?”

“I wanted to see you,” she said again. “I wanted to see you, so I hid on this ship—”

“You *hid* on it?”

“I’m a stowaway... I didn’t know what it would mean—”


“*Marilyn!*” It was the cry of a man who calls, hopeless and desperate, to someone already and forever gone from him. “What have you done?”

“I... it’s not—” Then her own composure broke and the cold little hand gripped his shoulder convulsively. “Don’t, Gerry — I only wanted to see you; I didn’t intend to hurt you. Please, Gerry, don’t feel like that—”

Something warm and wet splashed on his wrist, and he slid out of the chair to help her into it and swing the microphone down to her level.

“Don’t feel like that. Don’t let me go knowing you feel like that—”

The sob she had tried to hold back choked in her throat, and her brother spoke to her. “Don’t cry, Marilyn.” His voice was suddenly deep and infinitely gentle, with all the pain held out of it. “Don’t cry, Sis — you mustn’t do that. It’s all right, honey — everything is all right.”

 “I—” Her lower lip quivered and she bit into it. “I didn’t want you to feel that way — I just wanted us to say goodbye, because I have to go in a minute.”

“Sure — sure. That’s the way it’ll be, Sis. I didn’t mean to sound the way I did.” Then his voice changed to a tone of quick and urgent demand. “EDS — have you called the *Stardust*? Did you check with the computers?”

“I called the *Stardust* almost an hour ago. It can’t turn back; there are no other cruisers within forty light-years, and there isn’t enough fuel.”

“Are you sure that the computers had the correct data — sure of everything?”

“Yes — do you think I could ever let it happen if I wasn’t sure? I did everything I could do. If there was anything at all I could do now, I would do it.”

“He tried to help me, Gerry.” Her lower lip was no longer trembling and the short sleeves of her blouse were wet where she had dried her tears. “No one can help me and I’m not going to cry anymore and everything will be all right with you and Daddy and Mama, won’t it?”

“Sure — sure it will. We’ll make out fine.”

Her brother’s words were beginning to come in more faintly, and he turned the volume control to maximum. “He’s going out of range,” he said to her. “He’ll be gone within another minute.”

“You’re fading out, Gerry,” she said. “You’re going out of range. I wanted to tell you — but I can’t now. We must say goodbye so soon — but maybe I’ll see you again. Maybe I’ll come to you in your dreams with my hair in braids and crying because the kitten in my arms is dead; maybe I’ll be the touch of a breeze that whispers to you as it goes by; maybe I’ll be one of those gold-winged larks you told me about, singing my silly head off to you; maybe, at times, I’ll be nothing you can see, but you will know I’m there beside you.

Think of me like that, Gerry; always like that and not — the other way.”

Dimmed to a whisper by the turning of Woden, the answer came back:


“Always like that, Marilyn — always like that and never any other way.”

“Our time is up, Gerry — I have to go now. Good—” Her voice broke in midword and her mouth tried to twist into crying. She pressed her hand hard against it and when she spoke again the words came clear and true:

“Goodbye, Gerry.”

Faint and **ineffably** poignant and tender, the last words came from the cold metal of the communicator:


“Goodbye, little sister...”

 She sat motionless in the hush that followed, as though listening to the shadow-echoes of the words as they died away; then she turned away from the communicator, toward the air lock, and he pulled down the black lever beside him. The inner door of the air lock slid swiftly open to reveal the bare little cell that was waiting for her, and she walked to it.


She walked with her head up and the brown curls brushing her shoulders, with the white sandals stepping as sure and steady as the fractional gravity would permit and the gilded buckles twinkling with little lights of blue and red and crystal. He let her walk alone and made no move to help her, knowing she would not want it that way. She stepped into the air lock and turned to face him, only the pulse in her throat to betray the wild beating of her heart.

“I’m ready,” she said.

He pushed the lever up and the door slid its quick barrier between them, enclosing her in black and utter darkness for her last moments of life. It clicked as it locked in place and he jerked down the red lever. There was a slight waver of the ship as the air gushed from the lock, a vibration to the wall as though something had bumped the outer door in passing; then there was nothing and the ship was dropping true and steady again. He shoved the red lever back to close the door on the empty air lock and turned away, to walk to the pilot’s chair with the slow steps of a man old and weary.

 Back in the pilot’s chair he pressed the signal button of the normal-space transmitter. There was no response; he had expected none. Her brother would have to wait through the night until the turning of Woden permitted contact through Group One.

It was not yet time to resume deceleration, and he waited while the ship dropped endlessly downward with him and the drives purred softly. He saw that the white hand of the supply-closet temperature gauge was on zero. A cold equation had been balanced and he was alone on the ship. Something shapeless and ugly was hurrying ahead of him, going to Woden, where her brother was waiting through the night, but the empty ship still lived for a little while with the presence of the girl who had not known about the forces that killed with neither hatred nor malice. It seemed, almost, that she still sat, small and bewildered and frightened, on the metal box beside him, her words echoing hauntingly clear in the void she had left behind her:

I didn’t do anything to die for... I didn’t do anything...  10

Also on this page...

[Meet the Writer](#)

MEET THE WRITER

Tom Godwin

A Sci-fi Pioneer

Tom Godwin (1915–1980) had a difficult start in life. He had to leave school after third grade because of family problems, and he suffered from a curvature of the spine. He later tried to earn a living in two very different fields — as a prospector and as a writer of science fiction.

Godwin lived for many years in various small towns in the Mojave Desert in southeastern California — a harsh environment that many people might consider as alien as outer space. Perhaps his surroundings influenced his first sci-fi stories, which appeared in 1953 in a pioneering sci-fi magazine called *Astounding Science Fiction*.

When “The Cold Equations,” his most popular and controversial short story, appeared in the August 1954 issue of *Astounding*, many readers were shocked and angry. They wanted Godwin’s “problem story” to have a happy ending, a last-minute way of saving the young stowaway.

Godwin published more than a dozen short stories and several novels, including *The Survivors* (1958) and *The Space Barbarians* (1964), but none of his works caused the stir of “The Cold Equations.” His later writing continued to explore similar themes about the harsh indifference of nature to human survival.

Also on this page...

[The Cold Equations
\(continued\)](#)

CONNECTION/POEM

All Watched Over by Machines of Loving Grace

Richard Brautigan



I like to think (and
the sooner the better!)
of a cybernetic meadow
where mammals and computers

5 live together in mutually
programming harmony
like pure water
touching clear sky.

I like to think

10 (right now, please!)
of a cybernetic forest

filled with pines and electronics
where deer stroll peacefully
past computers

- 15 as if they were flowers
with spinning blossoms.

I like to think
(it has to be!)
of a cybernetic ecology

- 20 where we are free of our labors
and joined back to nature,
returned to our mammal
brothers and sisters,
and all watched over

- 25 by machines of loving grace.

RESPONSE AND ANALYSIS

The Cold Equations

Reading Check

1. **Summarize** the main events of this story in a paragraph. Open with a note describing the **setting**, and then tell who the **characters** are and what their **problem** is. Be sure to explain how the problem is resolved.

Thinking Critically

2. What is the source of the story's **suspense** — that is, what questions kept you turning the pages? Did you have questions that the story didn't answer? Explain.
3. This story contrasts life on earth with life on the space frontier. In what important ways are those **settings** different? Do you find Godwin's space frontier believable? Why or why not?
4. Find the passage toward the middle of the story that explains its **title**. What are the "cold equations"? What other **images** of coldness can you find in the story?
5. Why do you suppose Godwin chose the **third-person-limited point of view** instead of making Barton the **first-person narrator**? How does the third-person-limited point of view affect the story's **tone**, **plot**, and **believability**? For help answering, try rewriting a brief passage in Barton's first-person voice.
6. How believable are Marilyn's choice to stow away and her later responses to her fate? If you were in her situation, how do you think you would react? Be sure to check your Quickwrite notes.
7. Do you think that Godwin and Brautigan (see the *Connection* on page 184) have similar or different attitudes toward technology? Explain your answer.



Extending and Evaluating

8. On page 167, we learn that Barton would have immediately carried out the regulation to eject the stowaway if it had been a man. What do you think of this attitude?
9. “The Cold Equations” was published in 1954, at a time when technology was far less advanced than it is now. Today we are living in what, to Godwin, was the future (though not as far in the future as the story is set). Do you think the technological “future” is turning out to be as cold and harsh as Godwin predicted? Explain your answer with specific examples from your own experience.

What Godwin Predicted	Today’s Reality

WRITING

The Best Solution?

Do you agree that Barton has no choice but to let Marilyn die? Consider the problem presented in the story, and write a **problem-solution essay** in which you develop and support your ideas about what could have been done differently in “The Cold Equations.”

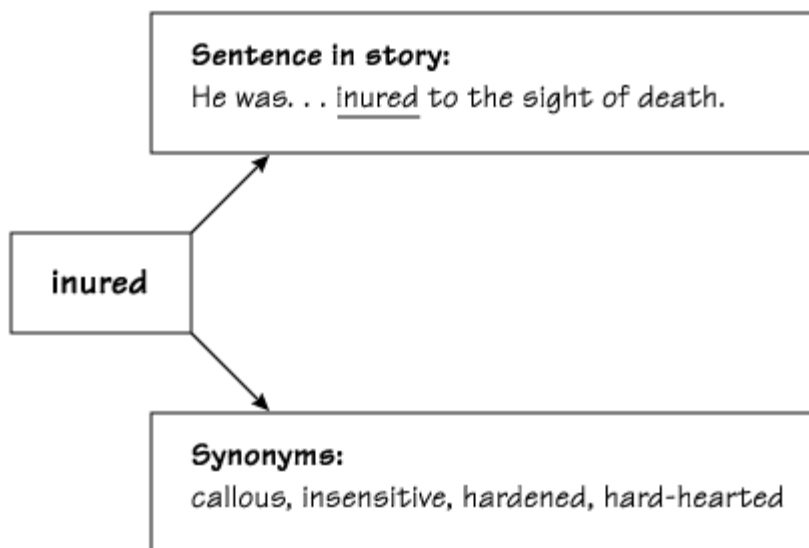
[Open the Online Notebook to write your responses.](#)

Use “Analyzing Problems and Solutions,” pages 212–219, for help with this assignment.

VOCABULARY DEVELOPMENT

Using a Thesaurus to Find Synonyms

A **synonym** is a word that has the same or nearly the same meaning as another word. To find synonyms, writers use a **thesaurus** (a dictionary of synonyms). Most thesauri list synonyms based on a word’s different shades of meaning, or **connotations**. You might want to look at all the synonyms and follow the cross-references given until you find the exact meaning you want to convey. See the example.



PRACTICE

Using a thesaurus, make **synonym charts** like the one above for the other Word Bank words. Before you list a synonym, check to be sure that it fits the meaning of the Word Bank word as it is used in the story.

[Open the Online Notebook to write your responses.](#)

Also on this page...

[Grammar Link](#)

GRAMMAR LINK

They Always Agree — Subject and Verb

One of the most common errors that people make in their writing and speaking has to do with subject-verb agreement. The rule is simple: **Singular subjects take singular verbs; plural subjects take plural verbs.** The trick is to find the subject and determine its **number**.

1. The number of the subject is not changed by a phrase following the subject.
The dials in the EDS control room were flashing.
2. Singular subjects joined by *or* or *nor* take a singular verb.
Neither Barton nor his supervisor wants to carry out the rules.
3. When a singular subject and a plural subject are joined by *or* or *nor*, the verb agrees with the subject nearer the verb.
Neither Barton nor his supervisors want to eject the girl.

PRACTICE

Identify each subject below, and determine its number. Then, choose the correct verb.

1. Marilyn or her brother (is/are) going to die.
2. Neither Barton nor his supervisors (was/were) willing to make an exception to the rule.
3. The men on the EDS team (is/are) obliged to eject Marilyn.

[Open the Online Notebook to write your responses.](#)

Tip: When you proofread your writing, always check the subject of each sentence, and be sure the verb agrees with it in number.

For more help, see Agreement of Subject and Verb, 2a–n, in the Language Handbook.

Also on this page...

[Vocabulary Development](#)

CONNECTION TO “THE COLD EQUATIONS”

Informational Text

Taste — The Final Frontier

Generating Research Questions

When you set out to do a research project, your first, crucial step is to generate good research questions that will yield specific, relevant information. To help jump-start your questions, you may want to read a general encyclopedia article about your subject.

Helpful Hints

Here are some guidelines for generating productive research questions from materials you read:

- **Stay focused.** Don’t write a long list of questions that cover everything you could possibly ask about a broad, general subject. Instead, zoom in on one aspect of your subject, and stick to questions about your narrowed topic. Try to identify the **main idea** of your topic to focus your questions better.
- **Check the subheads.** In an informational article, subheads indicate smaller divisions of the article’s subject. They may give you ideas for a limited topic to research.
- **Do what reporters do.** Research questions that can be answered with yes or no will get you nowhere. When reporters investigate a story, their questions begin with *who*, *what*, *where*, *when*, *why*, and *how*? (For example, Who are the people involved? What happened?) Asking these **5W-How? questions** will lead you to specific information.
- **Be realistic.** Ask questions that you think you can find answers to with the resources available to you.

To sum up: Your first research task is to generate productive questions. Keep your questions on target (focused on your limited topic), and make them specific.

Connecting to the Literature

Someday the space travel and colonization of other planets that is described in “The Cold Equations” may become a reality. Will space travelers be able to eat tasty and fresh foods, which until now have been missing from space missions? The following article discusses the plans and recipes that scientists are currently cooking up.

TASTE — THE FINAL FRONTIER

NEWSPAPER ARTICLE

Taste — The Final Frontier

from *The Guardian*, April 21, 2000

Esther Addley

Yuri Gagarin's first trip into space on April 12, 1961, was a brief one, which is perhaps just as well. If he'd stayed up any longer than his brief 108-minute orbit, he might have started getting peckish. And since no one had any idea whether humans could swallow in zero gravity, he hadn't been allowed to take any food. The Soviets were ignoring the recommendations of the British interplanetary society in 1939, which advised that astronauts should be fattened up in advance, then given a daily pound of butter while on board to fulfill their calorific needs.



Space nutrition has completed several missions of its own in the four decades since the final frontier was **breached**, and the popular image of high-protein slop that tastes like liquidized cardboard is now largely outdated. But while the presentation may have improved, astronauts broadly agree that food in space has remained pretty awful since John Glenn returned from his mission in 1962 demanding a real sandwich instead of mush in a tube.

The way we feed ourselves in space has actually changed very little. Foods are freeze-dried and vacuum-packed to weigh next to nothing; when you feel like lunch you select a sachet, add water, stir, and suck it out of the carton. Delicious.

The main challenge in cooking for long-haul astronauts, as anyone who has taken a transatlantic flight will know, is making the food **palatable**. NASA is careful to supply every vitamin, mineral, and calorie an astronaut requires, calculated to the minutest scale. But that doesn't mean it tastes nice. French astronaut Jean-Loup Chrétien described the Russian prepacked pot noodles on Mir as tasting like "**rancid** almonds;" his countryman Richard Filippi was so appalled at the menus that he devised a culinary art he called "gastronautics" to cater to the space station's final missions. "It was clearly unacceptable that a Frenchman should eat poorly in space," said Filippi. "Something had to be done." Astronauts, he figured, are like armies; they march — or spacewalk — on their stomachs.

It's not just that astronauts are fussy eaters. Russian cosmonauts were rumoured at one point to be close to **mutiny**, so bad was the food provided by their **impoverished** space agency. "It is extremely important that you have a varied diet in space," says Jean Hunter, associate professor of agricultural and biological engineering at Cornell University. "Food assumes an especially large role in psychological support of the crew. The astronauts are living in a **habitat** that doesn't change from day to day, so the most reliable source of variety in those conditions comes from the food."

The main gripe, unsurprisingly, is that nothing is fresh. Despite the introduction of refrigeration facilities, a locker of fresh apples and oranges will last only 48 hours. Then it's back to cartons, cans, and hot water, at least until a considerate shuttle drops by.


The solution? Grow the crops yourself. As well as providing variety, space crops would allow a future colony to be more self-sufficient. And it's not such a distant prospect. NASA has been investigating for some years the possibility of growing crops in space — artificially lit, watered, and temperature-controlled, of course. The atmosphere of Mars, 95% carbon dioxide, could be relatively easily managed for grain or vegetable production, the byproduct oxygen being used to produce water combined with imported hydrogen. And if the claims of ice having been discovered on the moon prove true, agriculture galactic-style could really be in

business.

Enter Hunter and her colleagues at Cornell. Raw grain or potato, after all, is unlikely to prove any more popular than in freeze-dried form. What astronauts will need is recipes, culinary tips, a cookbook. And this month 16 volunteers completed the first extended trial of moon food, for 30 days eating nothing but food that could, in theory, be grown and harvested on the moon or Mars.

“We developed more than 200 recipes using plants that could be grown in a lunar colony, in hydroponic cultures (that is, using nutrient-enriched fluid instead of soil) with artificial lighting, and looked at the ways they would have to be processed to turn them into food that people would want to eat,” says Hunter.

Considering the restrictions on which plants can be cultivated — they need to be short, high yielding, and require little maintenance — the potential variety of diet is impressive. Rice, wheat, potato, sweet potato, tomato, and other vegetables are all seen as prime candidates. Soy beans would give oil and milk; meat substitute could be made from wheat. With **judicious** use of flavoring, believe the researchers, the food produced could be extremely tasty. Sweet potato pancakes, lentil loaf sandwiches, or chocolate soy candy, anyone?

 Rupert Spies, senior lecturer at the university’s school of hotel administration and developer of most of the recipes, admits to being frustrated that all Mars menus must be low in salt, but says he got round it by adding “a lot of herbs.” “The lack of salt is very important because it affects the **metabolism** in space. Salt and bone loss is a very specific issue if you are in microgravity.”

At this stage, of course, all the recipes are necessarily vegan — tethering a cow to a star-spangled banner on the surface of the moon is not yet a viable option. But not all animal protein will eventually need to be imported. “It is a very, very long way off until we will be farming animals in space,” says Hunter. “But it does seem likely that the first meat animals will probably be fish, such as carp, because they can be grown in a closed system with very low water use.”

The prospect of allotments or fish farms dotted across the surface of Mars is an **arresting** one. But it is unlikely that astronauts will be training tomatoes up their mass spectrometers for a while yet. And it will take considerably longer before they can cut ties with mother earth altogether.

“It’s not worth attempting to be fully self-sufficient as a colony,” says Hunter. “There are so many other things you’d have to bring from earth, you might as well bring some food as well.” Exhausted astronauts might well agree. The average man requires 2.5 pounds of food a day. Tell an astronaut that he has to head off to the inflatable pod, harvest some grain, shell, grind, and cook it, and he might settle for powdered steak sandwich after all.

ANALYZING INFORMATIONAL TEXT

Taste — The Final Frontier

Reading Check

1. What is the astronauts’ main complaint about food in space?
2. Why do astronauts use freeze-dried food instead of fresh vegetables and fruits?
3. How might colonists on Mars grow fresh vegetables and raise carp?



[Open the question set and practice online.](#)

1. Which sentence states this article's **main idea**?
 - A. Astronauts' meals are freeze-dried and vacuum-packed.
 - B. Fresh vegetables may someday be grown aboard spaceships.
 - C. Space nutritionists are trying to solve the problem of unappetizing food in space.
 - D. A new recipe book has been compiled for astronauts who are vegetarians.
2. If you were researching the latest developments in food for U.S. astronauts, which question would provide the *most* relevant information?
 - A. How is food freeze-dried?
 - B. What is the history of hydroponic agriculture?
 - C. Do U.S. astronauts still complain about food on extended space missions?
 - D. What foods did U.S. astronauts eat during the last three space missions?
3. "What input have astronauts had in the most recent experiments on space food?" is a more useful research question than "Has space food changed since the 1960s?" because —
 - A. it is a broad, general question about growing food on Mars
 - B. it will yield specific information
 - C. it can be answered *yes* or *no*
 - D. it is about future events
4. Which of the following research questions is *not* related to the issues in this article?
 - A. How might grains and vegetables be grown on Mars?
 - B. What would be needed for astronauts to grow fresh vegetables aboard a space-flight?
 - C. Who would pay for constructing lunar colonies?
 - D. In a Martian or lunar colony, how might residents get food?

Constructed Response

Write five **research questions** about humans in space. Your questions may further explore space nutrition or a related topic that this article has made you curious about. Then, get together with three or four classmates to evaluate one another's questions. Decide which questions seem likeliest to yield good research results.

[Open the Online Notebook to write your responses.](#)

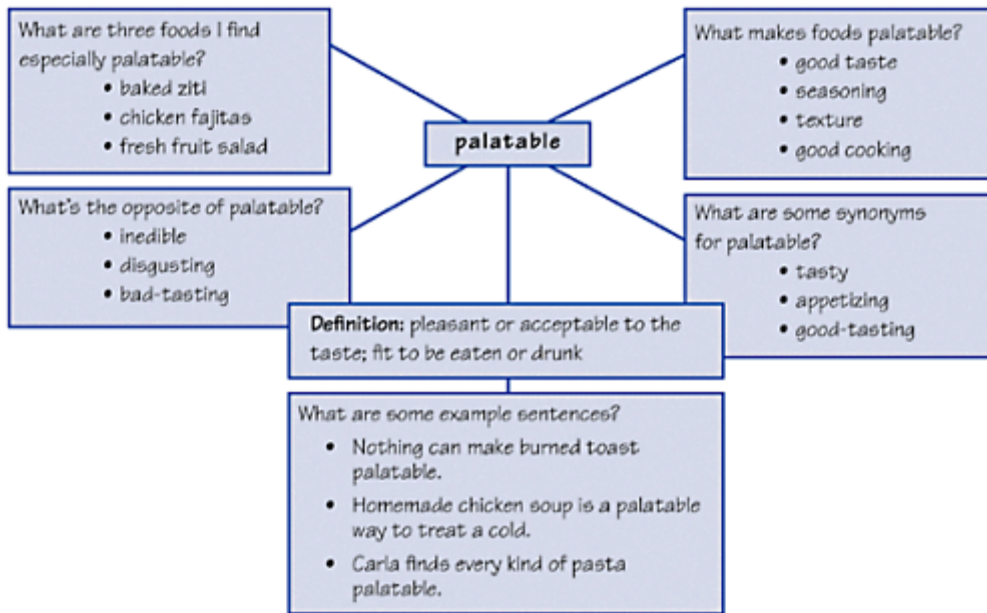
VOCABULARY DEVELOPMENT

Word Mapping: How to Own a New Word

Sometimes you can figure out a word from its context, but sometimes you can't. On page 188, the writer gives **context clues** — spread over three sentences — to help you understand what the word *palatable* means:

"The main challenge in cooking for long-haul astronauts, as anyone who has taken a transatlantic flight will know, is making the food *palatable*. NASA is careful to supply every vitamin, mineral, and calorie an astronaut requires, calculated to the minutest scale. But that doesn't mean it tastes nice."

Making a **semantic map**, or **meaning map**, can help you pin down the meaning of a new word. Here is a sample map for the word *palatable*. Note how the questions, answers, and examples show the word in action and help to clarify its meaning.



PRACTICE

With a partner, divide the remaining Word Bank words so that you each have four. Then, make a **semantic map** for each of your words. You may need to create some of your own questions and answers. When you finish, share your maps with those of your partner.

[Open the Online Notebook to write your responses.](#)