

**Passage I SOCIAL SCIENCE:**

To learn one's longitude at sea, one needs to know what time it is aboard ship and also the time at the home port or another place of known longitude—at that very same moment. The two clock times enable the

**5** navigator to convert the hour difference into a geographical separation. Since the Earth takes twenty-four hours to complete one full revolution of three hundred sixty degrees, one hour marks one twenty-fourth of a spin, or fifteen degrees. And so each hour's time difference

**10** between the ship and the starting point marks a progress of fifteen degrees of longitude to the east or west. Every day at sea, when the navigator resets the ship's clock to local noon when the sun reaches its highest point in the sky, and then consults the homeport

**15** clock, every hour's discrepancy between them translates into another fifteen degrees of longitude.

Those same fifteen degrees of longitude also correspond to a distance traveled. At the Equator, where the girth of the Earth is greatest, fifteen degrees stretch

**20** fully one thousand miles. North or south of that line, however, the mileage value of each degree decreases. One degree of longitude equals four minutes of time the world over, but in terms of distance, one degree shrinks from sixty-eight miles at the Equator to virtually

**25** nothing at the poles.

Precise knowledge of the hour in two different places at once—a longitude prerequisite so easily accessible today from any pair of cheap wristwatches— was utterly unattainable up to and including the era of

**30** pendulum clocks. On the deck of a rolling ship, such clocks would slow down, or speed up, or stop running altogether. Normal changes in temperature encountered en route from a cold country of origin to a tropical trade zone thinned or thickened a clock's lubricating oil and **35** made its metal parts expand or contract with equally disastrous results. A rise or fall in barometric pressure, or the subtle variations in the Earth's gravity from one latitude to another, could also cause a clock to gain or lose time.

**40** For lack of a practical method of determining longitude, every great captain in the Age of Exploration became lost at sea despite the best available charts and compasses. Untold numbers of sailors died when their destinations suddenly loomed out of the sea and took **45** them by surprise. In a single such accident on October 22, 1707, at the Scilly Isles near the southwestern tip of England, nearly two thousand men lost their lives.

The quest for a solution to the problem of longitude persisted over four centuries and across the whole

**50** continent of Europe. The British Parliament, in its famed Longitude Act of 1714, set the highest bounty of all, naming a prize equal to several million dollars in today's currency for a "Practicable and Useful" means of determining longitude.

**55** English clockmaker John Harrison, a mechanical genius who pioneered the science of portable precision timekeeping, devoted his life to this quest. He accomplished what Newton had feared impossible: He invented a clock that would carry the true time from the **60** home port, like an eternal flame, to any remote corner of the world.

With no formal education or apprenticeship to any watchmaker, Harrison nevertheless constructed a series of virtually friction-free clocks that required no lubrication **65** and no cleaning, that were made from materials impervious to rust, and that kept their moving parts perfectly balanced in relation to one another, regardless of how the world pitched or tossed about them. He did away with the pendulum, and he combined different **70** metals inside his works in such a way that when one component expanded or contracted with changes in temperature, the other counteracted the change and kept the clock's rate constant.

His every success, however, was parried by members **75** of the scientific elite, who distrusted Harrison's magic box. The commissioners charged with awarding the longitude prize changed the contest rules whenever they saw fit, so as to favor the chances of astronomers over the likes of Harrison and his fellow "mechanics."  
**80** But the utility and accuracy of Harrison's approach triumphed in the end. In 1773 he claimed his rightful reward. His followers shepherded Harrison's intricate, exquisite invention through the design modifications that enabled it to be mass produced and enjoy wide use.  
**85** To retrace this story in an age when a network of satellites can nail down a ship's position within a few feet in just a moment or two—is to see the globe anew.

### Questions:

1. The function of the first paragraph in relation to the passage as a whole is to:
  - A. orient the reader to the subject of longitude by explaining how longitude is determined at sea.
  - B. explain the political significance of developing an accurate way of determining longitude.
  - C. establish that longitude calculations are necessary to determine time in two different places at once.
  - D. introduce a discussion of how knowledge of Earth's position relative to the Sun was gained in the process of advances in timekeeping.
2. Which of the following best describes the way the fifth paragraph (lines 48–54) functions in the passage as a whole?
  - F. It puts into historical perspective the difficulty of solving the longitude problem and introduces the subject of Britain's longitude prize.
  - G. It translates the technical terminology used elsewhere in the passage into language that is more widely understood.
  - H. It sheds light on why it took longer for a solution to the longitude problem to emerge in Europe than in other parts of the world.
  - J. It diminishes the importance of the lives that were lost in the efforts to solve the longitude problem.

3. It can reasonably be inferred from the passage that before Harrison's efforts, other individuals trying to solve the longitude problem had failed to:

- A. consider clocks as the potential instrument of calculation.
- B. agree on why longitude decreases in value at increasing distances from Earth's equator.
- C. improve upon the features of clocks that made them unreliable at sea.
- D. understand the ways that charts and compasses could be used in connection with timepieces to calculate longitude.

4. The reference to the catastrophe at Scilly (lines 45–47) is used to illustrate the point made in the passage that:

- F. charts and compasses were poorly made in the 1700s.
- G. England more than other countries stood to gain from a solution to the problem of determining longitude.
- H. captains were contributing to the problem of lost lives by resisting a solution to the problem of determining longitude.
- J. Harrison's accomplishments addressed shortcomings of navigation whose consequences were vast in scale.

5. Information in the second paragraph (lines 17–25) establishes that one degree of longitude translates into a distance of:

- A. sixty-eight miles at Earth's equator but less on either side of Earth's equator.
- B. sixty-eight miles at Earth's equator but more on either side of Earth's equator.
- C. one thousand miles the world over.
- D. virtually nothing at Earth's equator, increasing to a maximum of sixty-eight miles at the poles.

6. Which of the following statements best describes the metals used in Harrison's clock?

- F. The metals were identical so that they would respond consistently to changes in conditions at sea.
- G. The metals were different so that their changes in response to conditions at sea would counteract each other.
- H. The metals that remained stable in response to temperature changes were encased in metals that were impervious to rust.
- J. The metals expanded and contracted in ways that were counteracted by changes in the parts made of wood.

7. The passage suggests that Harrison's principal competitors in the race to develop a means of determining longitude were:

- A. the great captains in the Age of Exploration.
- B. members of the British Parliament.
- C. trained clockmakers with formal education.
- D. individuals in the scientific community.

8. According to the passage, there was a delay between the time when Harrison arrived at a solution to the problem of longitude and when he received his reward because his:

- F. invention predated the Longitude Act of 1714.
- G. clock was only one of many successful solutions to emerge simultaneously.
- H. opponents obstructed his efforts to claim the prize money.
- J. supporters abandoned him in order to exploit his invention for their own financial gain.

9. Lines 82–84 indicate that others took over Harrison’s work in order to:

- A. secure a wider range of applications for an instrument that had been used only at sea.
- B. take credit for his remarkable accomplishments.
- C. diminish the significance of his clock by having it mass-produced.
- D. turn his design into one that could be practically produced for more users.

10. The passage indicates that instruments for determining longitude now include:

- F. modified pendulum clocks.
- G. satellites.
- H. a network of ships.
- J. barometers.

## **Passage II HUMANITIES:**

The meter of my childhood was the rising and plunging of a sewing machine needle: rapid and smooth, like an endless distant drum roll. My mother hummed as she sewed. She guided the fabric this way and that.

**5** In 1938, she had graduated from a school of costume design, and before World War II, she had her own boutique in Los Angeles. It was a time when the dream of America never seemed finer.

The Albany of my childhood was a festive place,

**10** closer in spirit to the nineteenth century than to the twenty-first. Italian pushcart grocers crowded southern city blocks, crafting tiered architectural wonders from fresh produce and pungent sausage. Heavy-legged workhorses clopped along cobblestones, delivering **15** bread from German bakeries and milk from Dutch dairies. A cable car ran along streets named for trees.

Each year in early April, an annual dinner-dance was sponsored by the pharmaceutical institute where my father worked as a researcher. A ballroom was

**20** rented in a downtown hotel. Musicians were hired to play big-band music. The dinner-dance was the only time when my mother would sew for herself. It was the one time when my parents went out, alone, together. I was a romantic child, dreamy and diffuse. For me, the **25** dinner-dance was an annual event: looked forward to in long anticipation and back upon with nostalgia.

Each year, on a snowy weekday evening, Father would take us window shopping. The deserted downtown streets would be a magical glaze of snow-softened lights and shadowy shop displays. My mother would linger in front of the mannequins clad in evening apparel. I would follow along, drunk with wonder. Each year before the tape had desiccated on the backs of the New Year’s cards and they had fallen to

**30** the floor, my mother would have decided on the design for her dinner-dance dress. Then there would be a trip to the fabric store. I would run my hands along graduated rainbows of thread spools. I would watch their changing hues as they shimmered in the light.

**40** As the dress took form, my parents would practice dancing.

“Slow, slow, quick, quick, slow,” Father would mutter with determination as he trod unmincingly on Okaa-chan’s feet and guided her into the walls.

**45** “Next lady?” he gallantly would inquire. My sister Misa and I would take turns, balancing on the tops of his shoes, as Father swept us around the room.

I always thought that Dinner-Dance Eve had some of the magic of Christmas. Every year, I would perch

**50** on the bathtub’s edge. I would watch my father fix his tie. “See the nice dimple below the knot?” Father would turn from the mirror and bend to show me. “The dimple is very important.” I solemnly would nod—the honored recipient of this arcane cultural wisdom.

**55** Back in the bedroom, Okaa-chan would slide into her new dress. She would glance at her reflection with modest pleasure. When she moved, I could catch the sweet scent of face powder.

**60** When I was seven or eight, the window shopping and the dinner-dances stopped. The granite façades of the downtown stores were grimy with graffiti. Display windows were boarded with plywood. The elegant hotels had fallen into disrepair. No one danced to bigband music anymore.

**65** As I grew older, my mother began to sew for wealthy women. The women lived in country homes where sunlight, reflected from swimming pools just beyond French doors, played across fine wood floors.

**70** Once after a luncheon in the city, a woman came to our house for a fitting. Standing erect in the doorway, then bowing slightly, my mother met her formally. “Won’t you please come in? May I please take your coat?” “Here you go. Try to put it somewhere clean.”

**75** Like an eagle, her words slipped regally down a great distance and struck with awful ease. After the fitting, my father was ashamed and angry.

“Actually, I do not like this work,” he stormed. “You do not have to do this; we do not need this kind of money.”

**80** He waved his arms dismissively at Okaachan’s sewing machine. “They come and look at our home with contempt. You kneel at their hems like a servant! Mo dame desu yo! It is no good, I tell you!”

Okaa-chan was intractable. Eloquent in anger, she

**85** blazed over the pronunciation of words that ordinarily would have left pondering pauses in her speech. “I do not care what they think of me, of our home. They cannot affect our value.” My mother stepped in front of her sewing machine, as if to shield it from scorn.

**90** “My work gives me happiness.” She squarely faced my father. “I do not care if you speak as Husband,” she said. “I am a Designer!”

Questions :

1. As it is described in the passage, sewing seems most closely associated in the narrator's mind with her mother's:

- A. low wages.
- B. compassion.
- C. self-worth.
- D. thriftiness.

2. It is reasonable to infer from the passage that the narrator looks back on the dinner-dances as a time when:

- F. her parents were in conflict over her mother's work.
- G. the entire family was filled with excitement and anticipation.
- H. she and her father had a much easier relationship with each other.
- J. her mother and father had renewed hope for the future of the family.

3. It is reasonable to infer that the primary reason the author included the information in the eleventh paragraph (lines 59–64) is to:

- A. contrast it with the earlier description of the family looking at shop displays on a snowy evening.
- B. support the information about the trip to the fabric store, which was presented earlier.
- C. compare it with the scene where the father dances with his wife and daughters.
- D. contrast it with the scene presented in the last two paragraphs (lines 78–92).

4. The primary focus of lines 65–92 is:

- F. the relationship between the narrator and her mother.
- G. Okaa-chan's strength and integrity.
- H. Albany's move toward the twenty-first century.
- J. the narrator's father's stubbornness.

5. When the narrator says, "I solemnly would nod—the honored recipient of this arcane cultural wisdom" (lines 53–54), she most likely means that:

- A. she felt intimidated when her father was giving her information that she did not understand.
- B. her father was honored to be able to share personal information with his daughter.
- C. when her father put on his tie, she pretended to be honored, even though she thought his comment was silly.
- D. the information her father was giving her seemed important and made her feel valued.

6. The sentence "Like an eagle, her words slipped regally down a great distance and struck with awful ease" (lines 75–76) indicates that the narrator:

- F. was not sure what her mother expected of her.
- G. recognized that her mother was being demeaned.
- H. wanted to distance herself from her mother.
- J. was ill at ease with her position in the family.

7. Information in the passage suggests that the narrator's father disapproves of Okaa-chan's sewing business primarily because it:

- A. diminishes his role as a provider.
- B. means more to her than he does.
- C. does not generate enough income.
- D. threatens his sense of dignity.

8. Based on the last two paragraphs (lines 78–92), which of the following statements indicates what the narrator's father and mother have in common?

- F. They both want control of the family finances.
- G. They are both fighting for their self-respect.
- H. They both want to teach a lesson to their children.
- J. They are both angry at the woman who came for the fitting.

9. The author uses the term "architectural wonders" (line 12) to describe:

- A. nineteenth-century buildings.
- B. German baked goods.
- C. crowded city blocks with cobblestone streets.
- D. arranged layers of fruits, vegetables, and sausages.

10. Which of the following words best describes the narrator's father's dancing as he practices for the dinner dance with Okaa-chan?

- F. Skillful
- G. Graceful
- H. Clumsy
- J. Indifferent

### **Passage III NATURAL SCIENCE:**

Nature's imagination, as Freeman Dyson likes to say, is richer than ours, and he speaks, marvellingly, of this richness in the physical and biological worlds, the endless diversity of physical forms and forms of life.

**5** For me, as a physician, nature's richness is to be studied in the phenomena of health and disease, in the endless forms of individual adaptation by which human organisms, people, adapt and reconstruct themselves.

Defects, disorders, diseases, in this sense, can play

**10** a paradoxical role, by bringing out latent powers, developments, evolutions, forms of life, that might never be seen, or even be imaginable, in their absence. It is the paradox of disease, in this sense, its "creative" potential, that forms the central theme of this book.

**15** Thus while one may be horrified by the ravages of developmental disorder or disease, one may sometimes see them as creative too—for if they destroy particular paths, particular ways of doing things, they may

**20** force the nervous system into making other paths and ways, force on it an unexpected growth and evolution. This other side of development or disease is something I see, potentially, in almost every patient; and it is this which I am especially concerned to describe.

Similar considerations were brought up by A. R. Luria,

**25** who studied the long-term survival of patients who had cerebral tumors or had suffered brain injuries or strokes—and the ways, the adaptations, they used to survive. He also studied deaf and blind children as a very young man (with his mentor L. S. Vygotsky).

**30** Vygotsky stressed the intactness rather than the deficits of such children:

A handicapped child represents a qualitatively different, unique type of development. . . . If a blind child or a deaf child achieves the same level of

**35** development as a normal child, then the child with a defect achieves this in another way, by another course, by other means; and, for the pedagogue, it is particularly important to know the uniqueness of the course along which he must lead the child.

**40** This uniqueness transforms the minus of a handicap into the plus of compensation. That such radical adaptations could occur demanded, Luria thought, a new view of the brain, a sense of it not as programmed and static, but rather as dynamic and

**45** active, a supremely efficient adaptive system geared for evolution and change, ceaselessly adapting to the needs of the organism—its need, above all, to construct a coherent self and world, whatever defects or disorders of brain function befell it. That the brain is minutely

**50** differentiated is clear: there are hundreds of tiny areas crucial for every aspect of perception and behavior. The miracle is how they all cooperate, are integrated together, in the creation of a self.

This sense of the brain's remarkable capacity for

**55** the most striking adaptations, not least in the special (and often desperate) circumstances of neural or sensory mishap, has come to dominate my perception of patients and their lives. So much so, indeed, that I am sometimes moved to wonder whether it may not be

**60** necessary to redefine the very concepts of "health" and "disease," to see these in terms of the ability of the organism to create a new organization and order, one that fits its special, altered disposition and needs, rather than in the terms of a rigidly defined "norm."

**65** Sickness implies a contraction of life, but such contractions do not have to occur. Nearly all of my patients, so it seems to me, whatever their problems, reach out to life—and not only despite their conditions, but often because of them, and even with their aid.

**70** The study of disease, for the physician, demands the study of identity, the inner worlds that patients, under the spur of illness, create. But the realities of patients, the ways in which they and their brains construct their own worlds, cannot be comprehended

**75** wholly from the observation of behavior, from the outside. With this in mind, I have taken off my white coat, deserted, by and large, the hospitals where I have spent the last twenty-five years, to explore my subjects' lives



**80** as they live in the real world, feeling in part like a naturalist, examining rare forms of life; in part like an anthropologist, a neuroanthropology, in the field—but most of all like a physician, called here and there to make house calls, house calls at the far borders of **85** human experience.

Questions :

1. The quotation by L. S. Vygotsky in lines 32–41 is used in this passage to support the idea that:

- A. children with handicaps should be studied in the same way as children defined by physicians as “normal.”
- B. deficits need to demonstrate intactness in order to be judged acceptable.
- C. neural or sensory mishap occurs in children as well as in adults.
- D. development of children with handicaps may proceed in positive yet quite distinctive ways.

2. The author of the passage refers to the work of A. R. Luria and L. S. Vygotsky primarily to underscore the idea that people who have:

- F. disabilities or developmental disorders learn to create new selves.
- G. disabilities or developmental disorders need special treatment.
- H. unusual handicaps are qualitatively different.
- J. neural mishaps have minutely differentiated brains.

3. Lines 42–53 suggest that, prior to A. R. Luria’s research, medical researchers had thought of the brain as:

- A. dynamic.
- B. unchanging.
- C. paradoxical.
- D. creative.

4. As it is used in line 41, the word compensation most nearly means:

- F. payment.
- G. differentiation.
- H. disposition.
- J. adaptation.

5. The author’s main purpose in lines 54–69 is to show:

- A. how he has come to think differently about the brain.
- B. why sickness often causes a contraction of life.
- C. when he had made new discoveries about the brain.
- D. which of his subjects helped him redefine the term “norm.”

6. The author of the passage makes it clear that, when it comes to understanding the effects of a disease on an individual patient, it is necessary for medical doctors to:

- F. adhere to established norms of human behavior in diagnosing and treating disease.
- G. quickly establishes a method of treatment that will save the patient from further suffering.

- H. examine the ways that people learn to live with a disease in their daily lives.
- J. know each person's brain is minutely differentiated and responsible for the disease being studied.

7. The last paragraph suggests that the author's main reason for leaving the hospital to visit his patients is to allow him to:

- A. feel more like a patient than a physician.
- B. become a more important part of the real world.
- C. understand his patients' illnesses better.
- D. see if being a naturalist is like being a physician.

8. The paradox mentioned in the second paragraph (lines 9–14) is best described by which of the following statements?

- F. The course of human evolution is guided by the creative potential of the static brain.
- G. Serious illness can lead directly to previously unthought of yet productive developmental change.
- H. Sickness may contract life, but in so doing it can maintain the physical "norm" at a similar level.
- J. The long-term study of disorders and diseases brings out the creative skills of researchers.

9. As it is used in line 15, the word ravages most nearly means:

- A. paradoxical features.
- B. creative adaptations.
- C. fatal nature.
- D. destructive actions.

10. The word miracle in line 52 refers most specifically to the ways in which:

- F. brain function disorders are cured.
- G. unique handicaps are compensated for.
- H. different areas of the brain work together.
- J. the creative potential of disease is revealed.