

[I]

Read the following article carefully and answer the questions. For each question, choose ONE BEST answer. On your answer sheet, find the number of the question and fill in the space that corresponds to the number of the answer you have chosen.

(Based on John Gribbin. 2002. *The Scientists*.)

① Science is a personal activity. With very few exceptions, scientists throughout history have plied their craft not through a lust for glory or material reward, but in order to satisfy their own curiosity about the way the world works. Some have taken this to such extremes that they have kept their discoveries to themselves, happy in the knowledge that they have found the solution to some particular puzzle, but feeling no need to boast about the achievement. Although each scientist—and each generation of scientists—exists and works in the context of their time, building on what has gone before with the [Q1] of the technology available to them, it is as individual people that they make their own contributions.

② [Q3] the process of doing science is a personal activity, science itself is essentially impersonal. It involves absolute, objective truths. A confusion between the process of doing science and science itself has led to the popular myth of the scientist as cold-blooded, logical machine. But scientists can be hot-blooded, illogical and even mad while still pursuing the search for ultimate truth. By some criteria, Isaac Newton was insane, both in his single-minded obsession with a succession of interests (science, alchemy, religion) and in the intensity of his personal vendettas, while Henry Cavendish*¹ was decidedly odd. So it is important to make the distinction between what is subjective, and therefore [Q4a] to debate, and what is objective and [Q4b] true.

③ Historians or sociologists who have no training in or experience of scientific research sometimes suggest that scientific truth is no more valid than artistic truth, and that, to put it crudely, Albert Einstein's general theory of relativity might go out of fashion just as much of the painting done by Victorian artists later went out of fashion. This is absolutely not so. Any description of the Universe that supercedes Einstein's theory must both go beyond the limitations of that theory and include all the successes of the general theory within itself, just as the general theory includes Newton's theory of gravity within itself. There will never be a successful description of the Universe which says that Einstein's theory is wrong in any of the areas where it has already been tested. It is a factual, objective truth that, for example, light gets 'bent' by a certain amount when it passes near a star like the sun, and the general theory will always be able to tell you how much it gets bent. At a simpler level, like many other scientific facts the inverse square law of gravity is an ultimate truth, in a way that no historical account of how that law was discovered can ever be 'the' truth. Nobody will ever know the extent to which Newton's thinking on gravity was influenced by observing the

fall of an apple; by the time he told the story, Newton himself might not have remembered the details correctly. But we can all know what law of gravity he discovered.

④ Scientists are well aware that words are merely labels which we use for convenience, and that a rose by any other name would smell as sweet*². That is why they deliberately choose to use a nonsense word, quark, as the label for a fundamental entity in particle theory, and why they use names of colours (red, blue and green) to identify different kinds of quark. They do not suggest that quarks really are coloured in this way. The difference between a scientific description of how apples fall and a [Q8a] description of how apples fall is that, whatever the name you ascribe to the phenomenon, in scientific terms it can be described by a precise law (in this case, the inverse square law) and that the same law can be applied to the fall of an apple from a tree, the way the moon is held in orbit around the Earth and so on out into the Universe. To a [Q8b], there is no reason why we should expect the way an apple falls from a tree to bear any relation to, say, the way that a comet moves past the Sun. But the word 'gravity' is simply a shorthand expression for the whole suite of ideas incorporated in Newton's *Principia* and Einstein's general theory of relativity. To a scientist, the word 'gravity' [Q10a] up a rich tapestry of ideas and laws, in the same way that to the conductor of a symphony orchestra the words 'Beethoven's Fifth' [Q10b] up a rich musical experience. It is not the label that matters, but the underlying universal law, giving a predictive power to science. We can say with confidence that planets (and comets) orbiting other stars are also under the influence of the inverse square law, whether you ascribe that law to 'gravity' or to 'God's will'; and we can be sure that any intelligent beings inhabiting those planets will measure the same inverse square law, although undoubtedly they will call it by a different name from the one we use.

⑤ Because there are ultimate truths out there, science hangs together so well. And what motivates the great scientists is not the thirst for fame or fortune (although that can be a seductive lure for the less-than-great scientists), but what Richard Feynman*³ called 'the pleasure of finding things out', a pleasure so satisfying that many of those great scientists, from Newton to Cavendish and from Charles Darwin to Feynman himself, have not even bothered to publish their findings unless pressed by their friends to do so, but a pleasure that would hardly exist if there were no truths to discover.

*¹ Henry Cavendish: (1731–1810) an experimental and theoretical English chemist and physicist, noted for his discovery of hydrogen.

*² a rose by any other name would smell as sweet: used from William Shakespeare's *'Romeo and Juliet'*, Act 2, Scene 2.

*³ Richard Feynman: (1918–1988) an American theoretical physicist who shared the 1965 Nobel Prize in Physics for elucidating how light interacts with matter.

Q 1 . In paragraph ① , which of the following could be best added in [Q1] ?

- 1 . adornment 2 . advise 3 . advisee 4 . aid 5 . assistant

Q 2 . Which of the following is true of the author's description in paragraph ① ?

- 1 . Satisfying curiosity is what drives science forward.
- 2 . Scientists need not build on what has come before them.
- 3 . The need for a solution overrides the need for satisfaction.
- 4 . Plying their craft for material reward is the goal of scientists.
- 5 . The personal nature of science necessitates that discoveries be kept to oneself.

Q 3 . In paragraph ② , which of the following could be best added in [Q3] ?

- 1 . Although 2 . Beyond 3 . Lest 4 . Only if 5 . Thereafter

Q 4 . In paragraph ② , which of the following contains a set of words that could be best added in [Q4a] and [Q4b], respectively?

	Q4a	Q4b
1 .	candid	considerably
2 .	down	unreasonably
3 .	neglected	ideally
4 .	open	unarguably
5 .	unnecessary	constructively

Q 5 . In paragraph ③ (line 2-3), the underlined phrase to put it crudely is closest in meaning to —

- 1 . at a minimum, it is likely
- 2 . at any cost
- 3 . at risk of being offensive
- 4 . to state in a complex manner
- 5 . to take it out carefully as a fact

Q 6 . In paragraph ④ (line 1), which of the following best expresses the essential information in the underlined phrase Scientists are well aware?

- 1 . Scientists know very well
- 2 . Scientists are rarely cautious
- 3 . Scientists understand vaguely
- 4 . Scientists are good at applying
- 5 . Scientists invest their knowledge

Q 7. In paragraph ④ (line 2), by referring to the idea that a rose by any other name would smell as sweet, the author suggests that labels do not really matter. Which of the following does the author mainly discuss in order to explain this idea?

- 1 . an apple on a tree 2 . Beethoven 3 . coloured particles
- 4 . gravity 5 . planetary comets

Q 8. In paragraph ④ , which of the following contains a set of words that could be best added in [Q8a] and [Q8b], respectively?

	Q8a	Q8b
1 .	logical	logistician
2 .	mystical	mystic
3 .	novel	writer
4 .	rigorous	sophist
5 .	statistical	statistician

Q 9. When the underlined word incorporated (paragraph ④ , line 13) is pronounced, one part (syllable) of the word should be emphasized the strongest. Which of the following has the same part that needs to be emphasized the strongest when pronounced?

- 1 . abomination 2 . appreciative 3 . humiliation
- 4 . popularity 5 . representative

Q10. In paragraph ④ , which of the following could be best added in both [Q10a] and [Q10b] ?

- 1 . clean(s) 2 . conceal(s) 3 . conjure(s) 4 . give(s) 5 . look(s)

Q11. In paragraph ⑤ (line 1), the underlined phrase hangs together is closest in meaning to —

- 1 . contains no pieces 2 . has minute gaps 3 . interconnects
- 4 . is completely sealed 5 . is permanent

Q12. In paragraph ⑤ (line 6), the underlined word pressed is closest in meaning to —

- 1 . flattened 2 . gripped 3 . machined 4 . printed 5 . urged

Q13. Which of the following is true of the author's description in this article?

- 1 . There is no confusion between the process of doing science and science itself.
- 2 . Objective truths cannot be discovered as part of an activity of personal pursuits.
- 3 . The enterprise of science moves forward only when its practitioners are logical and fair.
- 4 . In order for a new theory to completely overturn a preexisting theory, it need not prove the preexisting theory wrong in any circumstances.
- 5 . 'The Law of Gravity' is a convenient label for a discovery that would still be elegant even if it were categorized by a different collective name.

[II]

Read the following article carefully and answer the questions. For each question, choose ONE BEST answer. On your answer sheet, find the number of the question and fill in the space that corresponds to the number of the answer you have chosen.

(Based on Daniel J. Levitin. 2015. *The Organized Mind.*)

① Are there any biological constants to time? Our life span appears to be limited to about one hundred years (plus or minus twenty) due to aging. One theory used to be that life span limits are programmed into the genes to limit population size, but this has been dismissed because, in the harsh conditions of the wild, most species don't live long enough to age, so there would be no threat of overpopulation. A few species don't age at all and so are technically immortal. These include some species of jellyfish, flatworms (planaria), and hydra; the only causes of death in them are from injury or disease. This is in stark contrast to humans—of the roughly 150,000 people who die in the world each day, two-thirds die from age-related causes, and this number can reach 90% in peaceful industrialized nations, where war is [Q15] to shorten life.

② Natural selection has very limited or no opportunities to exert any direct influence on the aging process. Natural selection will tend to favor genes that have good effects on the organism early in life, prior to reproductive age, even if they have bad effects at older ages. Once an individual has reproduced and passed on his or her genes to the next generation, natural selection no longer has a means by which to operate on that person's genome. This has two consequences. If an early human inherited a gene mutation that rendered him less likely to reproduce—a gene that made him vulnerable to early disease or simply made him an unattractive mate—that gene would be less likely to show up in the next

generation. On the other hand, suppose there are two gene mutations that each conferred a survival advantage and made this early human especially attractive, but one of them has the side effect of causing cancer at age seventy-five, decades after the most likely age at which an individual reproduces. Natural selection has no way to discourage the cancer-causing gene because the gene doesn't show itself until long after it has been passed on to the next generation. Thus, genetic variations that challenge survival at an old age—variations such as a susceptibility to cancer, or weakening of the bones—will tend to accumulate as one gets older and farther away in time from the peak age of reproduction. (This is because such a small percentage of organisms reproduce after a certain age that any investment in genetic mechanisms for survival beyond this age benefits a very small percentage of the population.) There is also the Hayflick limit, which states that cells can divide only a maximum number of times due to errors that accumulate during successive cell divisions. The fact that we not only die but are aware that our time is limited has different effects on us across the life span.

③ At the level of hours and minutes, the most relevant constants are: human heart rates, which normally vary from 60 to 100 beats per minute; the need to spend roughly one-third of our time sleeping in order to function properly; and without cues from the sun, our bodies will drift toward a twenty-five-hour day. Biologists and physiologists still don't know why this is so. Moving down to the level of time that occurs at 1/1000 of a second are biological constants with respect to the temporal resolution of our senses. If a sound has a gap in it shorter than 10 milliseconds, we will tend not to hear it, because of resolution limits of the auditory system. For a similar reason, a series of clicks ceases to sound like clicks and becomes a musical note when the clicks are presented at a rate of about once every 25 milliseconds. If you're flipping through static (still) pictures, they must be presented slower than about once every 40 milliseconds in order for you to see them as separate images. Any faster than that and they exceed the temporal resolution of our visual system and we perceive motion where there is none (this is the basis of flipbooks and motion pictures).

④ When this happens, they allow us to see a view of the world that our eyes and brains would never see on their own. Shutter speeds of 125 and 250 provide [Q23] of the world in 8 millisecond and 4 millisecond slices, and this is part of our fascination with them, particularly as they capture human movement and human expressions. These sensory limits are constrained by a combination of neural biology and the physical mechanics of our sensory organs. Individual neurons have a range of excitement rates, on the order of once per millisecond to once every 250 milliseconds or so.

⑤ We have a more highly developed prefrontal cortex than any other species. It's the [Q24] of many behaviors that we consider distinctly human: logic, analysis, problem

solving, exercising good judgment, planning for the future, and decision-making. It is for these reasons that it is often called the central executive, or CEO of the brain. Extensive two-way connections between the prefrontal cortex and virtually every other region of the brain place it in a unique position to schedule, monitor, manage, and manipulate nearly every activity we undertake. Like real CEOs, these cerebral CEOs are highly paid in metabolic currency. Understanding how they work (and exactly how they get paid) can help us to use their time more effectively.

Q14. There are five paragraphs in this article. In which paragraph should the following sentence be added as the first sentence?

Photographs are interesting because they can capture and preserve the world at resolutions that exceed those of our visual system.

- 1. Paragraph ① 2. Paragraph ② 3. Paragraph ③
- 4. Paragraph ④ 5. Paragraph ⑤

Q15. In paragraph ①, which of the following could be best added in [Q15] ?

- 1. about 2. known 3. less likely 4. liable 5. supposed

Q16. Which of the following does NOT correspond to the author's description in paragraph ① ?

- 1. There are some biological species that can be considered immortal.
- 2. There are some species of jellyfish that die exclusively from injury or disease.
- 3. The proportion of people who die from age-related causes is not identical across countries.
- 4. Roughly speaking, less than 50,000 people around the globe die from age-related causes every day.
- 5. It was presumed in the past that the maximum time in which individuals were able to live was genetically determined.

Q17. In paragraph ② (line 1), the underlined word exert is closest in meaning to —

- 1. examine 2. exercise 3. experience 4. export 5. expose

Q18. In paragraph ② (line 7), the underlined word vulnerable is closest in meaning to —

- 1. attentive 2. available 3. immune 4. resistant 5. weak

Q19. In paragraph ② (line 9), the underlined word conferred is closest in meaning to —

1. absorbed 2. accorded 3. acknowledged 4. assorted 5. avoided

Q20. In paragraph ③ (line 7), the underlined word it refers to —

1. biological constant 2. gap 3. rate 4. sound 5. time

Q21. Which of the following best expresses the essential information in the underlined phrase temporal resolution in paragraph ③ (line 12) ?

1. the ability to distinguish things that are adjacent
2. the mechanism of humans' visual or auditory system
3. the extent to which a person is capable of following intonation of speech
4. the time to integrate pieces of information with respect to time and place
5. the amount of experiences required for our sensory system to function in a timely manner

Q22. Which of the following is true of the author's description in paragraph ③ ?

1. If a sound has a break in it shorter than 10 milliseconds, we will tend to hear the sound as being continuous.
2. It is possible for humans to visually capture the motion of static pictures as long as they are presented at an irregular pace.
3. With cues from the sun, human heart rates are strictly maintained from 60 to 100 beats per minute over a twenty-four-hour period.
4. One of the examples of biological constants at the level of hours and minutes is that the time needed for sleeping does not exceed 25% of our time.
5. There are few examples of biological constants at the level of seconds, because our sensory system could become less functional at that level of time frame.

Q23. In paragraph ④, which of the following could be best added in [Q23] ?

1. the formality 2. the pasting 3. the principle 4. samples 5. tools

Q24. In paragraph ⑤, which of the following could be best added in [Q24] ?

1. entrance 2. jacket 3. produce 4. seat 5. sensor

Q25. In paragraph ⑤ (line 6), the underlined word it refers to —

1. behavior 2. currency 3. decision making
4. the prefrontal cortex 5. every other region of the brain

Q26. Which of the following is NOT mentioned in this article?

1. Knowing how the cerebral CEOs operate will help us to enable more effective usage of their time.
2. Similar to real CEOs of companies, the prefrontal cortex is provided with sufficient metabolic resources.
3. Our sensory limits are restricted by neural biology as well as the physical mechanics of our sensory organs.
4. The fundamental difference between those species that do not age and those that age is the average number of deaths per day.
5. A gene inherited by an early human that reduces the probability of a person reproducing would be less likely to appear in the next generation.

[III]

Read the following article carefully and answer the questions. For each question, choose ONE BEST answer. On your answer sheet, find the number of the question and fill in the space that corresponds to the number of the answer you have chosen.

(Based on Daniel Kahneman. 2012. *Thinking, Fast and Slow*.)

① The trader-philosopher-statistician Nassim Taleb could also be considered a psychologist. In *The Black Swan*, Taleb introduced the notion of a *narrative fallacy* to describe how flawed stories of the past shape our views of the world and our expectations for the future. Narrative fallacies arise inevitably from our continuous attempt to make sense of the world. The explanatory stories that people find compelling are simple; are concrete rather than abstract; assign a larger role to talent, stupidity, and intentions than to luck; and focus on a few striking events that happened rather than on the countless events that failed to happen. Any recent salient event is a candidate to become the kernel of a causal narrative. Taleb suggests that we humans constantly fool ourselves by constructing flimsy accounts of the past and believing they are true.

② Good stories provide a simple and coherent account of people's actions and intentions. You are always ready to interpret behavior as a manifestation of general propensities and personality traits—[Q30] that you can readily match to effects. Something called the halo effect contributes to coherence, because it inclines us to match our view of all the qualities of a person to our judgment of one attribute that is particularly significant. If we think a baseball pitcher is handsome and athletic, for example, we are likely to rate him better at throwing the ball, too. Halos can also be negative: if we think a player is ugly, we will

probably underrate his athletic ability. The halo effect helps keep explanatory narratives simple and coherent by exaggerating the consistency of evaluations: good people do only good things and bad people are all bad. The statement “The dictator loved dogs and little children” is shocking no matter how many times you hear it, because any trace of kindness in someone who seems so evil violates the expectations set up by the halo effect. Inconsistencies reduce the ease of our thoughts and the clarity of our feeling.

③ A compelling narrative fosters an illusion of inevitability. Consider the story of how Google turned into a giant of the technology industry. Two creative graduate students in the computer science department at Stanford University come up with a superior way of searching information on the Internet. They seek and obtain funding to start a company and make a series of decisions that work out well. Within a few years, the company they started is one of the most valuable stocks in America, and the two former graduate students are among the richest people on the planet. On one memorable occasion, they were lucky, which makes the story even more compelling: a year after founding Google, they were willing to sell their company for less than \$1 million, but the buyer said the price was too high. Mentioning a single lucky incident actually makes it easier to underestimate the multitude of ways in which luck affected the outcome.

④ A detailed history would specify the decisions of Google's founders, but for our purposes it suffices to say that almost every choice they made had a good outcome. A more [Q35] narrative would describe the actions of the firms that Google defeated. The hapless competitors would appear to be blind, slow, and altogether inadequate in dealing with the threat that eventually overwhelmed them.

⑤ I intentionally told this tale blandly, but you get the idea: there is a very good story here. Fleshed out in more detail, the story could give you the sense that you understand what made Google succeed; it would also make you feel that you have learned a valuable general lesson about what makes businesses succeed. Unfortunately, there is good reason to believe that your sense of understanding and learning from the Google story is largely illusory. The ultimate test of an explanation is whether it would have made the event predictable in advance. No story of Google's unlikely success will meet that test, because no story can include the myriad of events that would have caused a different outcome. The human mind does not deal well with nonevents. The fact that many of the important events that did occur involve choices further tempts you to exaggerate the role of skill and underestimate the part that luck played in the outcome. Because every critical decision turned out well, the record suggests almost flawless prescience—but bad luck could have disrupted any one of the successful steps. The halo effect adds the final touches, lending an aura of invincibility to the heroes of the story.

⑥ Like watching a skilled rafter avoiding one potential calamity after another as he goes down the rapids, the unfolding of the Google story is thrilling because of the constant risk of [Q38]. However, there is an instructive difference between the two cases. The skilled rafter has gone down rapids hundreds of times. He has learned to read the roiling water in front of him and to anticipate obstacles. He has learned to make the tiny adjustments of posture that keep him upright. There are fewer opportunities for young men to learn how to create a giant company, and fewer chances to avoid hidden rocks—such as a brilliant innovation by a competing firm. Of course there was a great deal of skill in the Google story, but luck played a more important role in the actual event than it does in the telling of it. And the more luck was involved, the less there is to be learned.

⑦ At work here is that powerful WYSIATI* rule. You cannot help dealing with the limited information you have as if it were all there is to know. You build the best possible story from the information available to you, and if it is a good story, you believe it. Paradoxically, it is easier to construct a coherent story when you know little, when there are fewer pieces to fit into the puzzle. Our comforting conviction that the world makes sense rests on a secure foundation: our almost unlimited ability to ignore our ignorance.

* WYSIATI: What you see is all there is.

Q27. In paragraph ① (line 4), the underlined word inevitably is closest in meaning to —

1. ineffectively 2. merely 3. possibly 4. terribly 5. unavoidably

Q28. In paragraph ① (line 8), the underlined word kernel is closest in meaning to —

1. core 2. delivery 3. evidence 4. voice 5. whole

Q29. Which of the following is true of the author's description in paragraph ①?

1. People are prepared to believe a story that predicts the worst outcome.
2. Stories that people feel comfortable with tend to have concreteness, show complexity, and place a greater role in luck.
3. We as humans tend to create a narrative fallacy as our flawed past explanations can construct our current views and prospects for the future.
4. Although any past events could not distort our image of the current world, an account of earlier events tends to assure us that they are the facts.
5. As human beings constantly engage in attaching meanings to what is happening around them, we humans have the capability not to become a victim of a narrative fallacy.

Q30. In paragraph ②, which of the following could be best added in [Q30] ?

1. causes 2. costs 3. doses 4. sums 5. synonyms

Q31. Which of the following corresponds to the author's description in paragraph ② ?

1. People tend to favor a success story while being discouraged by its negative aspects.
2. People readily believe that good stories involve bad intentions, while good intentions are inherent in bad stories.
3. It would be impossible for us to become fond of only the speech style of a person, but dislike all other aspects of the person.
4. One person would be considered a more qualified pitcher than the other, because the former is less handsome and athletic than the latter.
5. Our tendency of connecting general propensities and personality traits to our evaluation of a particular attribute would keep our accounts simple and coherent.

Q32. Which of the following best expresses the essential information in the underlined sentence in paragraph ② ?

1. People are likely to believe that a bad person has both all bad and good qualities.
2. Fair assessment of a person, due to the halo effect, could result in inconsistent evaluations.
3. Violation of the cognitive pattern generated by the halo effect would help to decrease any imbalance of our body and mind.
4. Information that is contradictory to what we believe increases the complexity of our thinking process and lowers the clarity of our feeling.
5. The ease and the clarity of our thoughts and feelings are maintained largely by the consistency of our perceptions of a person and that person's expectation of us.

Q33. In paragraph ③ (line 1), the underlined word compelling is closest in meaning to —

1. avoiding 2. convincing 3. disorganizing
4. nurturing 5. overlapping

Q34. In paragraph ③ (line 3), the underlined phrase come up with is closest in meaning to —

1. confine 2. exhaust 3. formulate 4. prefer 5. resist

Q35. In paragraph ④, which of the following could be best added in [Q35] ?

1. biased 2. complete 3. concerted 4. negligible 5. psychological

Q36. In paragraph ⑤ (line 1), the underlined word blandly is closest in meaning to —

1. bravely 2. exaggeratedly 3. simply 4. negatively 5. passionately

Q37. Which of the following does NOT correspond to the author's description in paragraph ⑤ ?

1. No story can include every possible event that would have caused a different outcome.
2. It is reasonable to believe that our sense of understanding and learning from the Google story does not fully represent reality.
3. Any explanation of Google's success would fail the ultimate test, because it would not be able to predict its success in advance.
4. Multiple factors, including the halo effect, contribute to making us deceptively feel that we learn something from the Google story.
5. When constructing an explanation, people usually consider the information in a comprehensive manner by taking into account both things that did occur as well as things that did not occur.

Q38. In paragraph ⑥, which of the following could be best added in [Q38] ?

1. consequence 2. disaster 3. invasion 4. miracle 5. transmission

Q39. Which of the following is true of the author's description in paragraph ⑥ ?

1. Had the founders of Google had more business experience prior to Google, they could have become even more successful.
2. A rafting and a business story cannot be comparable, because while both involve uncertainty the former is less predictable than the latter.
3. People find the rafting story more fascinating than the Google story, because they want to believe that there exists some people with great luck.
4. There is less to be learned from the Google story, because luck played a more influential role in the actual event than it does in the story that is told.
5. One critical truth that is often missed in the Google story is that some people become successful only with sufficient opportunities to learn about an ideal business model.

Q40. In paragraph ⑦ (line 5), the underlined word conviction is closest in meaning to —

1. belief 2. distrust 3. guilt 4. instinct 5. stay

Q41. In this article, which of the following is NOT discussed as a characteristic or tendency of human beings?

- 1 . If we think a person is good looking, we are likely to rate his or her ability favorably.
- 2 . We tend to make a story that we think would be more favorable from others' points of view.
- 3 . We construct stories that are not based on the complete facts, but we believe that they are real.
- 4 . We tend to consider the limited information at hand as if that were all there were to be known.
- 5 . We tend to believe that a person's behavior is a representation of his or her general personality traits.