Passage I: Standard Approach – Highlighting

Bright young scientists must learn through trial-and-error to separate failure to achieve the expected results from failure of the experiment altogether, and when it comes to the latter, technical failures (such as miscalibrations of instrumentation or other careless oversights) from personal failure. For scientists who are just starting to conduct real research – that is, research in which one does not know what to expect as an outcome, rather than the carefully con- trolled "experiments" students conduct in the lab solely as a way to learn good lab techniques – a series of setbacks or the failure of a major project can quickly lead to a lack of faith in the experimental process itself. Such failure can create a sense of anxiety over the future of the project, especially in an environment in which the need for funding creates a pressing need to generate positive results quickly. This mental and financial pressure robs the young scientist of the fundamental right of all experimenters: the right to make mistakes. The greatest scientific discoveries have come not after a carefully and elegantly controlled series of pre-planned steps, but rather through the lumpy, uneven process of trial-and-error in which serendipity plays a significant role. But to that scientist who learns the wrong lesson from failure too strongly and too early in her career, the basic enterprise of science ceases to be a learning from failure and instead simply becomes failure.

The scientist's main recourse is to simply recast all lab work as a learning process in which it is the process of experimenting itself that is a success, such that there are no failures. The real sense of oneself as a scientist comes from an ability to understand "failures" as a chance to learn either something about the mechanics of lab work, or something about the system being investigated. The exploration itself becomes the central process of developing the young scientist. If the scientist makes a technical mistake in the operation of a piece of lab equipment, it is an opportunity to develop the toolset that will allow future investigations to proceed more smoothly, whereas if the results are simply wildly different than expected, it gives the scientist an opportunity to investigate something new and interesting about the world. In either case, the central mental faculty being prodded is the scientist's primary tool: curiosity.

An openness and curiosity about the world itself is, of course, the primary motivator for most of those who embark on the scientific journey to begin with. And failure is not always a frustrating setback that many first believe. It was, after all, the failure of Alexander Fleming to properly care for his petri dishes that led to the discovery of penicillin, or Wilson Greatbach's inadvertent use of a resistor a thousand times too strong that led to the development of the pacemaker. These sparks of genius and the exhilaration they bring are scattered liberally throughout the entire history of science. Ironically, one of the great curses that can befall a fledgling scientist is to experience not a great stroke of failure at the start of his career, but rather one of these great strokes of luck. If the talented young researcher has such a lucky moment, and comes to believe that such breakthroughs are the normal course of affairs, he may come to think after a subsequent few years of failure that he critically lacks some skill at research and may be driven into a more reliable profession, such as science teaching or science journalism.

Anyone who has devoted their life's work to the laboratory must ultimately have a moment in their career when their curiosity about the research itself, rather than the accolades it may bring, creates a sense of joy. This joy for working in the lab, in which the enterprise ceases to be work and becomes neither a vocation nor an avocation and instead becomes simply a way of life, is the foundational basis for that critical transformation: from a mere technician to a true scientist. Whatever technical mishaps may happen, whatever moments of serendipity may arrive, and whatever the results may show or fail to show, it is the curiosity and joy of discovery that define the scientist.

1. In paragraph three, the author mentions a “failure” of Alexander Fleming and an “inadvertent” action by Wilson Greatbach. In context, these words suggest that at least part of scientific discovery:

A) requires making technical mistakes.
B) can only happen to fledgling scientists who have a great stroke of luck.
C) involves doing things that might typically be considered mistakes.
D) is motivated by a desire for accolades.

2. The author implies that scientists who persist in their careers as research scientists do so because they:

A) seek the accolades that come from making a major breakthrough.
B) are compelled by a sense of curiosity about the world.
C) would not be happy in a reliable profession such as teaching or journalism.
D) experience pressure to obtain funding by demonstrating positive results.

3. All of the following are stated in the passage EXCEPT:

A) Making discoveries in the lab creates a sense of curiosity about the world.
B) Failure to produce positive results quickly can discourage new scientists.
C) Recasting both technical failures and unexpected results as successes can encourage scientists.
D) Failure is not always a setback.

4. In another work, the author of the passage states that approximately half of promising young Ph.D. candidates who appear as second or third authors on research papers early in their studies eventually either fail to complete their degree or do so without publishing any other original research. This is most likely due to:

A) new researchers failing to cultivate a sense of curiosity that lets failure be reinterpreted as success.
B) a stroke of serendipity occurring early in the career of young scientists.
C) a failure to distinguish between mere technical failures and a failure to achieve the expected results.
D) a desire to become either a science journalist or a science teacher.

5. One science journalist remarked, “no one likes the blind fumbling about that leads to the lucky discovery; everyone likes having made the lucky discovery”. The passage suggests that fledgling scientists who prefer “having made the lucky discovery” might be expected:

A) to make more lucky discoveries.
B) to give up research science.
C) to increase their technical facility in the lab.
D) to develop a stronger curiosity about the world.

6. The passage most strongly supports which of the following in regards to scientists?

A) They frequently experience failure through the process of trial-and-error.
B) Some of the greatest scientists had sloppy lab technique that led to technical failure.
C) Whether or not one achieves great success as a scientist depends solely on luck.
D) Their work transforms who they are by transforming their way of life.

7. Which of the following, if true, would most weaken the assertions made by the author?

A) Scientists should treat the lab as something of a playground in which their imagination can be given free rein.
B) A scientist prone to technical errors is displaying a personal failure through carelessness and should seek another line of work.
C) Scientists must cultivate a deep sense of patience since the lucky discovery may come along only after many years.
D) A scientist is fundamentally an explorer and is at her best when she is off the map: there can be no mistakes
because there are no lines to cross.

Passage II: Slow Read Approach – Note-taking

Epiphenomenalism is a theory of mind that posits that mental events are caused by underlying physical events, but that those mental events cannot then cause physical changes. That is, it is not the subjective sensation of nervousness that causes perspiration, but rather the perspiration is caused by a physiological reaction. This reaction also produces a sensation of nervousness, but that "feeling" is just a side-effect. Thomas Henry Huxley likened the mind to the whistle on a steam loco- motive; while the whistle may announce that the train is coming, it has no effect on the actual operation of the train itself.

The development of epiphenomenalism as a school of thought is rooted in the attempt to solve the basic problem of Cartesian dualism. In the 19th century, philosophers wrestled with the problem of interaction between two seemingly incompatible substances: the mental and the physical. The huge successes of the Enlightenment and the scientific tradition that grew out of it demonstrated humanity's increasing mastery over the realm of the physical, but the mental remained largely opaque, governed by theories and attitudes that could at best be called "folk psychology". In light of this disparity, thinkers in the early 19th century wondered how it was that mind and body could interact.

Descartes posited that there was a special organ – the pineal gland – in the center of the brain that provided a two-way link between the substances of mind and body. This organ explained the truth of our basic perception that the body can affect the mind (e.g. putting wine into the body can cloud the mind), and that the mind can affect the body (e.g. our desire to get some fresh air can send the body out for a walk).

The epiphenomenalists countered that although the mind may be a substance different from the body, it has no causative power on the body. This view flourished as it was consonant with the scientific behaviorism that was coming into vogue at the turn of the 20th century. Such scientific behaviorists, notably Ivan Pavlov, John Watson, and Burrhus Skinner, found great success in their efforts to investigate the relationship between environmental stimuli and behavior exhibited by animals (including humans), while making no reference whatsoever to the mental state of the subject. While such behaviorists would not have made the absurd proposal that the subject has no mental state at all, they sim- ply treated the mental state as causally irrelevant. If an animal's "feelings" cannot have any effect on its behavior, then we may safely ignore them in constructing our experiments and our theories about how animals behave, they held.

Epiphenomenalism faced a number of challenges throughout the past century, but since the cognitive revolution in the 1960's, it has received a number of surprising new avenues of support. In the more modern understanding, mental states are simply physical states in the brain–a thought is simply a pattern of electrical impulses traveling along neurons, a memory a growth of new connections between neurons, a feeling an increased level of certain neurotransmitters in certain anatomical regions. The epiphenomenon is the purely subjective, qualitative aspect of an experience. Such aspects are usually referred to as the "raw feel" of an experience, or the "what-it-is-like", or most often, "qualia". Thus if a dog and a robot that can perfectly mimic the behavior of a dog are both fed a piece of bacon, they will exhibit exactly the same behavior, but only the real dog will be experiencing the qualia of the food. The saltiness of the salt, the richness of the smell, the pleasure of eating will only be present in the epiphenomenal world that is the dog's brain. Both will bark happily, wag their tails, and scarf the food down in a single bite, but only the dog has a mind that will be experiencing the qualia of the food.

A large body of neurophysiological data seem to support epiphenomenalism. Such data includes a number of kinds of electrical potentials which occur in the brain and which cause behavior, and yet happen before the subject is men- tally aware of the event. Research shows that it takes at least half a second for a stimulus to

become part of conscious experience, and yet subjects are capable of reacting to that stimulus in less than half that time. Thus it is not our consciousness that controls our behavior, but rather our brain reacts and the "mental feeling" of what's happening comes after the fact.

8. Consider the case of the dog and dog-like robot discussed in the fifth paragraph. Descartes would assert that:

A) the existence of a robot dog that can perfectly mimic the real dog refutes his theory of dualism.
B) both the real dog and the robot dog have minds that are linked to their bodies through the pineal gland.
C) the real dog has a rudimentary mind that is fundamentally different from its body, whereas the robot has only a body.
D) the robot dog's qualia have some additional, unknowable property that separates the robot dog from the real one.

9. According to the passage, the raw feel of an experience arises from a brain state that is also the cause of any behavior we exhibit in response to that experience but that the feel itself is causally irrelevant. That view would most be weakened if it were discovered that which of the following were true?

A) The electrical potentials that happen in response to a stimulus before the subject is aware of the experience happen most strikingly in the case of olfactory stimuli.
B) When a subject is unconscious they are still capable of reacting to a number of different stimuli.
C) Anger management classes have been shown to stimulate a portion of the prefrontal cortex that is associated with "cooling down" and "thinking things through before you act" and that those regions exhibit activity before subsequent behavioral actions designed to reduce physiological arousal.
D) Meditation techniques that teach a person to avoid harmful repetitive thought patterns have been shown to be effective in the treatment of a number of mental illnesses that had previously only been considered treatable through powerful drugs or surgery.

10. Why does the author discuss the belief of Descartes that the brain has a special gland to mediate interactions between the body and the soul?

A) To show that Descartes's error about the function of the pineal gland serves as a fatal blow to the soundness of his philosophical theory
B) To refute Descartes's theory of mind/body dualism
C) To acknowledge that even Descartes knew that true dualism was impossible and that the mind must, at least in part, be a physical thing
D) To demonstrate that Descartes was aware that physical things that affect the body could alter the mind even though the mind is a fundamentally different substance from the body

11. The common experience of a violent shocked reaction (shouting, flinching, etc.) when seeing someone in the same room when you thought you were alone, even when that person is someone very familiar serves as evidence:

A) for both epiphenomenalism and materialism.
B) for neither dualism nor epiphenomenalism.
C) for dualism but not epiphenomenalism.
D) against the notion that mind/body interactions are mediated by the pineal gland.

12. Which of the following is most analogous to the function of the mind in epiphenomenalism?

A) The gasoline used to run a motor that drives a boat forward.
B) The beauty of a flower that inspires a poet to write a poem.
C) The tension an audience feels while watching a suspenseful movie.
D) The sunlight glinting off waves on the surface of a calm lake.

13. In an experiment subjects are made to look at a series of shocking and disturbing images flashed on the screen for a very short period of time. What does the passage suggest may happen in the brains of these subjects?

A) Their pineal glands will suffer stress in response to the disturbing images.
B) Some physiological responses may occur before the subject is mentally aware of what they're looking at.
C) The parts of their brains responsible for registering disgust will be stimulated only after the subjects have a subjective feeling of disgust.
D) At least some of the subjects will stop looking at the screen after they realize the images are all disturbing.

Passage III: Quick Read Approach – Skimming

In his recent book, The Genius of Dogs: How Dogs are Smarter than You Think, Brian Hare argues that the communicative abilities of dogs extend well past the blunt signifiers of tail and ear position and bared teeth that humans have long known. If you ask the typical lay person, he would suggest that dog vocalizations consist of little more than barking, growling, and whining. And while Hare's work doesn't expand on this basic repertoire, he convincingly argues that dogs are communicating far more than we were previously aware, through some combination of pitch, loudness and timbre.

Even many dog owners think that a dog's bark contains very little information. That is, the dog isn't "thinking" any- thing in particular, nor trying to communicate anything in particular. They bark just because "that's what dogs do". Research by Raymond Coppinger seems to support what he calls an "arousal model". That is, dogs simply bark when they're excited about something, and the barking is not a behavior over which the dog is exerting any conscious control and with no attempt at communication by the dog. In support of his hypothesis, Coppinger presents data gathered from several different breeds of working dogs whose job is to protect free-range livestock. In many instances, the dogs barked nearly continuously for six to eight hours, even when no other dogs or humans were within earshot. The bark simply communicates the fact that the barking dog is excited, with no attempt to communicate that message to any particular audience. Hare provides an anecdote that seems to align with the arousal model: he talks about a guard dog he had while working in Africa who would bark at every passerby throughout the night, even when they were people the dog had known and lived with for years.

More recent research, however, suggests that barking and growling may communicate more than had been previously thought. Dogs' vocal cords are highly flexible, permitting dogs to alter their vocalizations to produce a wide variety of different sounds. Scientists recorded the barking and growling done by dogs under a variety of situations. One involved a recording of a "food growl" and a "stranger growl". The first was recorded when researchers attempted to take food away from an aggressive dog, and the second when they simply approached aggressive dogs. They then placed food on the opposite side of the room from another dog and let it approach the food. They played back recordings of both the "stranger" and "food" growls as the dogs approached the food. Only in response to the "food" growl did the dogs hesitate before continuing.

In a similar experiment, researchers recorded the barks of dogs in two different situations. In the first, the dogs were simply left alone. In the second, a stranger would approach the dog, eliciting barking. When those barks were played later for other dogs, these other dogs ignored all of the "alone" barking, but perked up immediately when the "stranger" bark was played. Even more surprising, humans were able to distinguish between the barks, and correctly identify which was which, even if the human test subjects were not themselves dog owners.

Hare also notes that barking behavior itself seems to be an unintended consequence of domestication. While wolves and dogs share many behavioral characteristics (and, in fact, dogs were reclassified in 1993 as a subspecies of wolf), wolves rarely bark. Barking makes up only a small percent – by Hare's estimates as low as 3% – of wolf vocalizations. In addition, the experimental foxes in Russia that have been "force domesticated" over the span of just a handful of generations have shown the same split: the wild-type foxes don't bark, whereas the domesticated ones do. The artificial selection process that selects against aggression and fear in canids seems to have unearthed a propensity for barking.

14. Based on the information in the passage, the presence of barking behavior in the absence of other dogs or humans supports the idea that:

A) dogs' highly flexible vocal cords permit them to bark for a variety of purposes.
B) some barking behavior indicates the emotional state of the dog without communicative intent.
C) the arousal model fails to account for a common observation made by dog owners.
D) Hare's work is fundamentally flawed.

15. The passage suggests that recordings of dogs barking, to be useful in studying dog communication, must be:

A) made when attempting to take food away from a dog.
B) of particularly high quality so as to be recognizable by other dogs.
C) intelligible to a human audience.
D) recorded in response to a specific situation being studied.

16. Animal researchers have recorded a set of vocalizations made by hyenas in conjunction with several different hyena behaviors commonly exhibited in the wild. If the researchers wanted to speculate on the function of those vocalizations, Hare would suggest that they:

A) play those recordings to human listeners and ask the humans to distinguish between the vocalizations.
B) use a spectrograph to analyze the pitch, loudness, or timbre of the vocalizations.
C) compare the vocalization behavior of hyenas with their nearest domesticated relative.
D) play those recordings to other hyenas and observe their reactions.

17. Based on the passage, which of the following pieces of background knowledge would be most helpful in evaluating Hare's contentions?

A) Knowledge of how vocalization developed as a communication tool in people
B) An understanding of the different sorts of jobs for which dogs have been bred
C) A familiarity with the normal set of behaviors and vocalizations exhibited by wolves
D) A familiarity with the skeletal anatomy of a typical dog

18. Which of the following would most strengthen Coppinger's theory about the function of barking?

A) There are perceptible differences between the barks of dogs who are being threatened by larger animals and those being threatened by smaller animals.
B) When fed a slight sedative, the barking activity of dogs tended to increase in response to strangers.
C) Wolves show an increased amount of barking when kept in captivity.
D) When given food that contained small doses of stimulant drugs but provided with no environmental cues, dogs increased the duration and frequency of their barking.

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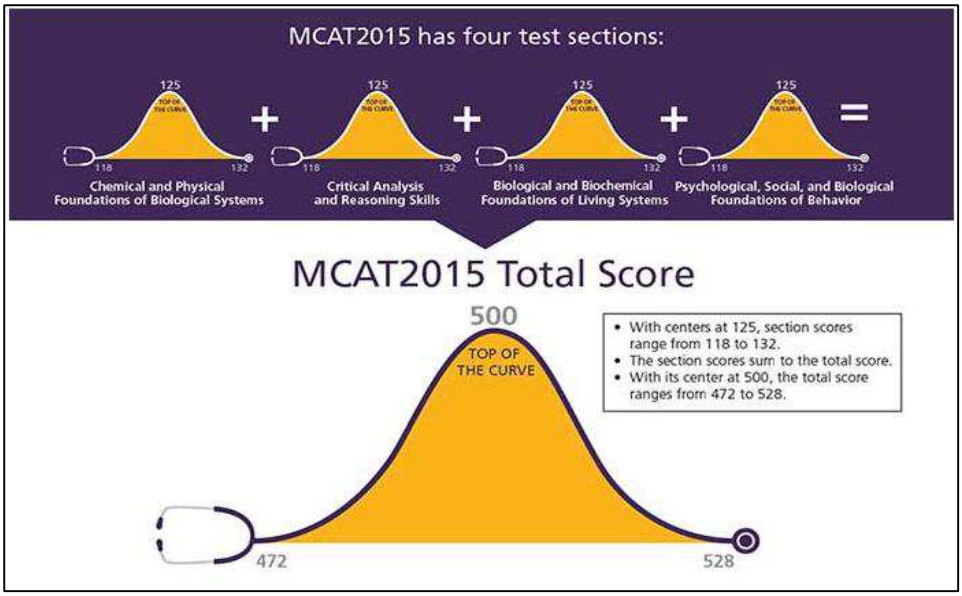

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Statistics: 1 semester
Humanities: 1-3 semesters

Answer Key

Passage 1

1. C
2. B
3. A
4. A
5. B
6. A
7. B

Passage 2

8. C
9. C
10. D
11. B
12. D
13. B

Passage 3

14. B
15. D
16. D
17. C
18. D