Five Sample Analytical Reasoning Questions and Explanations

Directions: Each group of questions in this section is based on a set of conditions. In answering some of the questions, it may be useful to draw a rough diagram. Choose the response that most accurately and completely answers the question and blacken the corresponding space on your answer sheet.

Passage for Question 1

A medical clinic has a staff of five doctors—Drs. Albert, Burns, Calogero, Defeo, and Evans. The national medical society sponsors exactly five conferences, which the clinic's doctors attend, subject to the following constraints:

If Dr. Albert attends a conference, then Dr. Defeo does not attend it.
If Dr. Burns attends a conference, then either Dr. Calogero or Dr. Defeo, but not both, attends it.
If Dr. Calogero attends a conference, then Dr. Evans does not attend it.
If Dr. Evans attends a conference, then either Dr. Albert or Dr. Burns, but not both, attends it.

Question 1

If Dr. Burns attends one of the conferences, then which one of the following could be a complete and accurate list of the other members of the clinic who also attend that conference?

(A) Drs. Albert and Defeo
(B) Drs. Albert and Evans
(C) Drs. Calogero and Defeo
(D) Dr. Defeo
(E) Dr. Evans

Explanation for Question 1

This question requires you to determine, from the conditions given, which doctors can attend the same conferences. The question tells us that "Doctor Burns attends one of the conferences," and we are asked to choose the response that could be a list of all and only those doctors who attend the conference with Dr. Burns. Since we are asked what could be a "complete and accurate list" [emphasis added] of those doctors who attend the conference with Dr. Burns, we can eliminate as incorrect those responses which either are inaccurate (that is, cannot be true), or incomplete (that is, do not include everyone who must accompany one or more of the doctors going to the conference). This can be determined easily without the use of a diagram.

Response (A) states that, along with Dr. Burns, Drs. Albert and Defeo also attend the conference. But the first condition tells us that "if Dr. Albert attends a conference, then Dr. Defeo does not attend it." So, Drs. Burns, Albert, and Defeo cannot all attend the same conference. Response (A), then, is incorrect.

Response (B) is incorrect for a similar reason. The fourth condition tells us what must be true if Dr. Evans attends a conference, namely, that "either Dr. Albert or Dr. Burns, but not both, attends it." Since we know that Dr. Burns attends the conference, we know that it cannot be true that both Drs. Albert and Evans also attend that conference.

Response (C) is also incorrect. The second condition tells us what must be true if Dr. Burns attends a conference. Since we know that Dr. Burns does attend the conference, we also know that "either Dr. Calogero or Dr. Defeo, but not both, attends it."

Responses (D) and (E) must be evaluated slightly differently. No condition rules out Dr. Burns's and Dr. Defeo's going to the same conference—response (D)—and no condition forbids Dr. Evans's going with Dr. Burns to a conference—response (E). But recall that the question asks for what could be a "complete and accurate list" of the doctors who attend the conference with Dr. Burns. We know from the second condition that at least one other person must accompany Dr. Burns, and that among those who accompany Dr. Burns are either Dr. Calogero or else Dr. Defeo. Since the conditions do not require anyone to accompany Dr. Defeo, it is possible that Dr. Defeo is the only

person to accompany Dr. Burns. Thus, response (D) is an accurate response, in that it is possible that Drs. Burns and Defeo attend the same conference, and it is a complete response, in that Drs. Burns and Defeo could be the only doctors of the five to attend the conference. So response (D) is correct.

Response (E) is incorrect because we know that if Dr. Burns goes, someone other than Dr. Evans must also go. Response (E) then is incomplete. It fails to list at least one doctor whom we know must also accompany Dr. Burns.

This question is classified as "moderately difficult."

Passage for Questions 2 and 3

Seven piano students—T, U, V, W, X, Y, and Z—are to give a recital, and their instructor is deciding the order in which they will perform. Each student will play exactly one piece, a piano solo. In deciding the order of performance, the instructor must observe the following restrictions:

X cannot play first or second.
W cannot play until X has played.
Neither T nor Y can play seventh.
Either Y or Z must play immediately after W plays.
V must play either immediately after or immediately before U plays.

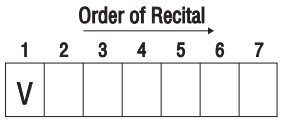
Question 2

If V plays first, which one of the following must be true?

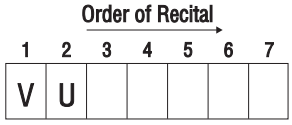
(A) T plays sixth.
(B) X plays third.
(C) Z plays seventh.
(D) T plays immediately after Y.
(E) W plays immediately after X.

Explanation for Question 2

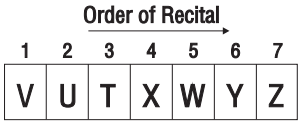
This question deals with an ordering relationship defined by a set of conditions as to when the seven piano students will perform. As an aid in visualizing this problem we can draw a simple diagram that shows the seven recital slots arranged in order from left to right. Student V is shown in the first slot, as specified by the condition that "V plays first":



We can immediately fill in one of the empty slots in the diagram. The condition that "V must play either immediately after or immediately before U plays" tells us that U must occupy the second slot in the recital schedule. This is shown below:



Since the question asks us what must be true, we can eliminate incorrect responses by showing that they could be false without violating the conditions. Response (A) is incorrect because the statement that "T plays sixth" is not necessarily true—we can place T in one of the slots other than sixth and still meet all the conditions of the problem. One such recital schedule, with T playing third, is shown in the diagram below:



We can develop this schedule as follows. With V, U, and T in the first three positions, there are four positions left for W, X, Y, and Z.

- W must come after X—because of the condition that "W cannot play until X has played"—so if we put X fourth and W fifth, this condition will be met.

- This leaves two possible slots for Y and Z. Y cannot play seventh because of the condition that "Neither T nor Y can play seventh," so we will place Y sixth and Z seventh.

A check will verify that this schedule meets the given conditions of the problem, including the one that "Either Y or Z must play immediately after W plays."

The schedule shown in the diagram also demonstrates that response (B) is incorrect. In it, X plays fourth, so it is not correct that the statement, "X plays third," must be true.

Response (C), "Z plays seventh," is the credited response. We can show this by demonstrating that:

- all the conditions can be met with Z in the seventh slot, and

- some of the conditions would be violated with Z in any slot other than seventh.

To demonstrate that Z can play seventh, we can refer to the schedule that was developed for the discussion of response (A), above. In it, Z plays seventh, and all the conditions in the problem are met.

To demonstrate that Z cannot play in a slot other than seventh, we can attempt to find another student to play seventh. We already know that neither U nor V can play seventh. Hence, there are four remaining players: T, W, X, and Y. However, a review of the given conditions shows that none of those players can play seventh:

- The third condition states that "Neither T nor Y can play seventh."

- W can't play seventh, because there must be a slot following W's in order to meet the condition, "Either Y or Z must play immediately after W plays." If W plays seventh, then there is no such slot left for Y or Z.

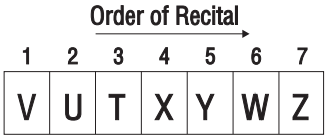
- For a similar reason X can't play seventh, because there must be a slot following X's in order to meet the condition, "W cannot play until X has played."

Since Z can play seventh and no other player can, then the statement that Z must play seventh is correct and (C) is the credited response.

Response (D) is incorrect because it is not necessarily true that "T plays immediately after Y." In our discussion of response (A), we developed a schedule in which T plays third and Y plays sixth, yet all conditions are satisfied.

Response (E) is incorrect because, as shown in the diagram below, it is not necessarily true that "W plays immediately after X." This schedule is obtained by simply reversing the order of players W and Y in the schedule we developed in the analysis of response (A).

A review will show that all of the given conditions are met by this schedule.



This question is classified as "difficult."

Question 3

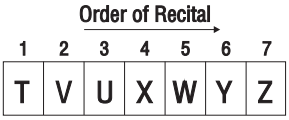
If U plays third, what is the latest position in which Y can play?

(A) first
(B) second
(C) fifth
(D) sixth
(E) seventh

Explanation for Question 3

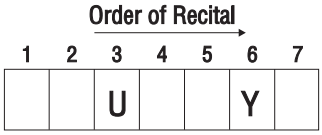
This question involves the same original conditions as the previous problem, but it begins with a different assumption: "U plays third." The test taker must determine what effect this assumption would have on the possible positions in which Y can appear in the recital schedule.

The correct response is (D), because student Y can play as late as sixth under the given constraint that "U plays third." The diagram below shows a recital order that meets all the given conditions and has Y performing in the sixth position.



One strategy for arriving at this solution is to work backward to see which position is the latest in which we can place Y and at the same time produce a recital schedule that meets all the given conditions.

Using that approach, we immediately see that Y cannot play as late as seventh, because of the condition that "Neither T nor Y can play seventh." Backing up and placing Y sixth, we can begin to fill in the schedule, as follows:



This schedule has five empty slots, into which we must fit players T, V, W, X, and Z. The following is a series of reasoning steps that can be used:

- From our analysis of the previous question, we know that players T, W, and X cannot play seventh, but that Z can, so we can tentatively place Z in the seventh slot.
- We also know that "Either Y or Z must play immediately after W plays." If we place W in the fifth slot, this condition will be met.
- By placing V in the second slot, we can meet the condition that "V must play either immediately after or immediately before U plays."

- We must place the remaining two players, T and X, in the two remaining slots, the first and the fourth. Because the first condition states that "X cannot play first … ," we will place X in the fourth slot and T in the first. These positions will meet the conditions that apply to T and X: T will avoid playing seventh and X will play before W.

Since Y can play as late as sixth, response (D) is the correct solution.

This question is classified as "moderately difficult."

Passage for Questions 4 and 5

On a particular Saturday, a student will perform six activities— grocery shopping, hedge trimming, jogging, kitchen cleaning, laundry, and motorbike servicing. Each activity will be performed once, one at a time. The order in which the activities are performed is subject to the following conditions:

Grocery shopping has to be immediately after hedge trimming.
Kitchen cleaning has to be earlier than grocery shopping.
Motorbike servicing has to be earlier than laundry.
Motorbike servicing has to be either immediately before or immediately after jogging.

Question 4

If laundry is earlier than kitchen cleaning, then hedge trimming must be

(A) fifth
(B) fourth
(C) third
(D) second
(E) first

Explanation for Question 4

This problem is concerned with determining the order in which six activities will be performed. As with many questions involving relative ordering or ranking, it is likely that you will find it useful to diagram the various relationships given in the passage.

The first condition in the passage tells us that grocery shopping has to be immediately after hedge trimming, which we can abbreviate as follows:

1. HG

The second condition tells us that kitchen cleaning has to be earlier than grocery shopping, which we can abbreviate as follows, where "…" is used to represent "earlier than" (which means any time before, including immediately before):

2. K…G

The third condition tells us that motorbike servicing has to be earlier than laundry, and the fourth condition tells us that motorbike servicing has to be either immediately before or immediately after jogging. These conditions can be abbreviated as follows, where the / symbol is used to represent "or":

3. M…L

4. MJ/JM

Notice that the information specified in these four conditions can be collapsed into two ordering statements:

I. K…HG (first and second conditions)

II. MJ/JM…L (third and fourth conditions)

Question 7 introduces the new supposition "laundry is earlier than kitchen cleaning":

L…K

This new supposition works to further collapse the ordering statements in I and II to the single statement below; that is, if L must be earlier than K, then we know that the activities must be ordered like this:

MJ/JM…L…K…HG

So, with the addition of the new supposition, there are exactly two possible orderings of the six activities, differing only with respect to whether motorbike servicing is immediately before or immediately after jogging:

1	**2**	**3**	**4**	**5**	**6**
M	J	L	K	H	G
J	M	L	K	H	G

Question 7 asks what position hedge trimming must be in, given the new supposition. What we see here is that hedge trimming must be the fifth activity performed, and so answer choice (A) is correct.

This question is classified as "easy."

Question 5

Which one of the following, if substituted for the condition that motorbike servicing has to be earlier than laundry, would have the same effect in determining the order of the student's activities?

(A) Laundry has to be one of the last three activities.
(B) Laundry has to be either immediately before or immediately after jogging.
(C) Jogging has to be earlier than laundry.
(D) Laundry has to be earlier than hedge trimming.
(E) Laundry has to be earlier than jogging.

Explanation for Question 5

This question asks you to select the condition which, if substituted for the third condition in the passage (repeated below), would have the same effect as the original condition.

Third condition: Motorbike servicing has to be earlier than laundry.

In this case, you can deduce that the correct answer choice is (C):

(C) Jogging has to be earlier than laundry.

The fourth condition in the passage tells you that motorbike servicing has to be either immediately before or immediately after jogging. That is, M and J must be ordered as a block, either MJ or JM, with respect to the other four activities. Thus, if, as the original third condition states, M has to be earlier than L, then we know that J must also be earlier than L. Conversely, if, as the new condition in answer choice (C) states, J has to be earlier than L, then we know that M must also be earlier than L. In short, the third condition and answer choice (C) have exactly the same effect. Therefore, answer choice (C) is correct.

Another way to approach this kind of question is to attempt to eliminate all of the incorrect answer choices. Under this approach, you want to rule out any answer choice that does either of the following:

- rules out outcomes that the original condition allows
- allows outcomes that the original condition rules out

Let's see how this approach would enable us to eliminate answer choices (A), (B), (D), and (E).

Consider the condition presented in answer choice (A):

(A) Laundry has to be one of the last three activities.

We can first ask whether this condition would rule out outcomes that the original third condition allows. To answer this question, we must simply determine whether there is an outcome allowed by the original third condition along with the other conditions in which laundry is one of the first three activities. Here is such an outcome:

1	**2**	**3**	**4**	**5**	**6**
M	J	**L**	K	H	G

Because the original third condition allows this outcome, but the condition in answer choice (A) does not, answer choice (A) cannot be correct.

Consider answer choice (B):

(B) Laundry has to be either immediately before or immediately after jogging.

Again, we want to first determine whether this new condition would rule out outcomes that the original third condition allows. To answer this question, we must simply determine whether there is at least one outcome allowed by the original third condition along with the other conditions in which laundry is neither immediately before nor immediately after jogging. Here is one such outcome:

1	**2**	**3**	**4**	**5**	**6**
K	H	G	J	M	**L**

This outcome, although allowed by the original third condition, would be ruled out by the alternative condition given in answer choice (B). Thus, answer choice (B) cannot be correct.

Next consider answer choice (D):

(D) Laundry has to be earlier than hedge trimming.

Again, we want to first determine whether this new condition would rule out outcomes that the original third condition allows. To answer this question, we must simply determine whether there is at least one outcome allowed by the original third condition along with the other conditions in which laundry is not earlier than hedge trimming. One such outcome was given immediately above: since L is not earlier than H in this outcome, it would be ruled out by the condition in answer choice (D). So, answer choice (D) rules out an outcome that the original third condition allows, and therefore (D) cannot be the correct answer choice.

Finally, consider answer choice (E):

(E) Laundry has to be earlier than jogging.

Again, we want to first determine whether having this new condition would rule out outcomes that are allowed when the original third condition is in place. To answer this question, we must simply determine whether there is at least one outcome allowed by the original third condition along with the other conditions in which laundry is not earlier than jogging. One such outcome was given above: since L is not earlier than J in this outcome, it would be ruled out

by the condition presented in answer choice (E). So, answer choice (E) rules out an outcome that the original third condition allows, and therefore (E) cannot be the correct answer choice.

In sum, answer choices (A), (B), (D), and (E) can all be eliminated because in each case the condition is one that rules out outcomes that the original condition allows. For this particular question, there was no need to consider whether any of the options could be eliminated because they allowed outcomes that the original condition ruled out.

This question is classified as “moderately difficult.”

Five Sample Logical Reasoning Questions and Explanations

Directions: The questions in this section are based on the reasoning contained in brief statements or passages. For some questions, more than one of the choices could conceivably answer the question. However, you are to choose the best answer; that is, the response that most accurately and completely answers the question. You should not make assumptions that are by commonsense standards implausible, superfluous, or incompatible with the passage. After you have chosen the best answer, blacken the corresponding space on your answer sheet.

Question 1

Electrons orbit around the nucleus of an atom in the same way that the Earth orbits around the Sun. It is well known that gravity is the major force that determines the orbit of the Earth. We may, therefore, expect that gravity is the main force that determines the orbit of an electron.

The argument above attempts to prove its case by

(A) applying well-known general laws to a specific case
(B) appealing to well-known specific cases to prove a general law about them
(C) testing its conclusion by a definite experiment
(D) appealing to an apparently similar case
(E) stating its conclusion without giving any kind of reason to think it might be true

Explanation for Question 1

This question requires the examinee to identify the method exhibited in an argument. The passage draws a parallel between two cases that share a similar trait: (1) the orbit of electrons around an atom's nucleus and (2) the orbit of the Earth around the Sun in our solar system. It uses knowledge about the second case (the fact that "gravity is the major force that determines the orbit of the Earth") to draw an inference about the first (that "gravity is the main force that determines the orbit of an electron"). The passage is "appealing to an apparently similar case" (the role of gravity in determining the Earth's orbit) to establish a conclusion about the role of gravity in determining an electron's orbit. Therefore, (D) is the credited response.

Response (A) is incorrect because it mistakes the argument made in the passage, based on an analogy, for an argument that applies "well-known general laws to a specific case." For the facts in this passage, such an argument from general laws to a specific case would go as follows:

1. General law: For all bodies in orbit, gravity is the main force that determines the body's orbit.
2. Specific case: An electron is a body in orbit.
3. Conclusion: Gravity is the main force that determines an electron's orbit.

Comparing this with the passage makes it clear that the argument in the passage builds its case on an apparently analogous situation, not on a general law. That the law of gravity, a well-known general law, applies to the specific case of the orbit of electrons is the conclusion the argument is drawing, not the method by which the argument attempts to prove its case.

Response (B) is incorrect because the argument is not trying to prove a general law about both electrons and planets. Its conclusion is only about electrons and their nuclei based on information about a comparable case.

Response (C) is incorrect because there is no evidence in the passage that the argument is using data from an experiment to make its point.

Response (E) is incorrect because the argument clearly does provide a reason for its conclusion, which can be stated as follows: since an electron orbits around its nucleus in the same way as the Earth orbits around the Sun, it is logical to conclude that there are other similarities between the two phenomena.

This test question is classified as “moderately difficult.”

Question 2

During the construction of the Quebec Bridge in 1907, the bridge’s designer, Theodore Cooper, received word that the suspended span being built out from the Bridge’s cantilever was deflecting downward by a fraction of an inch [2.56 centimeters]. Before he could telegraph to freeze the project, the whole cantilever arm broke off and plunged, along with seven dozen workers, into the St. Lawrence River. It was the worst bridge construction disaster in history. As a direct result of the inquiry that followed, the engineering “rules of thumb” by which thousands of bridges had been built around the

world went down with the Quebec Bridge. Twentieth-century bridge engineers would thereafter depend on far more rigorous applications of mathematical analysis.

Which one of the following statements can be properly inferred from the passage?

(A) Bridges built before about 1907 were built without thorough mathematical analysis and, therefore, were unsafe for the public to use.
(B) Cooper’s absence from the Quebec Bridge construction site resulted in the breaking off of the cantilever.
(C) Nineteenth-century bridge engineers relied on their rules of thumb because analytical methods were inadequate to solve their design problems.
(D) Only a more rigorous application of mathematical analysis to the design of the Quebec Bridge could have prevented its collapse.
(E) Prior to 1907 the mathematical analysis incorporated in engineering rules of thumb was insufficient to completely assure the safety of bridges under construction.

Explanation for Question 2

The question requires the examinee to identify the response that can be properly inferred from the passage. The passage indicates that the Quebec Bridge disaster in 1907 and the inquiry that followed caused the engineering “rules of thumb” used in construction of thousands of bridges to be abandoned. Since the Quebec Bridge disaster in 1907 prompted this abandonment, it can be inferred that these were the rules of thumb under which the Quebec Bridge was being built when it collapsed and that these were the rules of thumb used in bridge building before 1907. Further, since the Quebec Bridge collapsed while under construction and the rules of thumb being used were abandoned as a result, it can be inferred that the rules of thumb used in building the Quebec Bridge and bridges prior to 1907 were insufficient to completely assure the safety of bridges under construction. Finally, since the alternative to the old engineering rules of thumb that was adopted was to “depend on far more rigorous applications of mathematical analysis,” it can be inferred that it was the mathematical analysis incorporated in the engineering rules of thumb used prior to 1907 that made them insufficient to completely assure the safety of bridges under construction. Thus, (E) is the credited response.

Response (A) is incorrect. (A) asserts that the lack of thorough mathematical analysis in construction of bridges before about 1907 was sufficient to establish that those bridges were unsafe for the public to use. But, the rules of thumb used in bridge construction before 1907 were abandoned because they were not sufficient to establish that the bridges being constructed using them were safe when under construction. It does not follow that the lack of more rigorous or thorough mathematical analysis in the rules of thumb was sufficient to establish that the bridges built before about 1907 using them were unsafe even while under construction, let alone for the public. In fact, some, or even all, may have been quite safe. In addition, the passage gives evidence only about the safety of bridges built before 1907 while they were under construction. It is silent on whether bridges built before about 1907 were safe when open for use by the public.

Response (B) is incorrect in claiming that Cooper’s absence from the construction site caused the breaking off of the cantilever.

The passage does not establish that, had Cooper been at the site, he could have successfully intervened to prevent the cantilever from breaking off. By freezing the project, he might have spared lives by stopping work, but there is

nothing in the passage to indicate that he necessarily would have prevented the collapse.

Response (C) is incorrect; there is no evidence in the passage about why nineteenth-century engineers relied on their rules of thumb.

Response (D) is also incorrect. While the passage suggests that a more rigorous application of mathematical analysis would have prevented the collapse of the bridge, it offers no evidence that it is the only way the collapse could have been prevented. For example, it might have been prevented had corrective measures been taken in time.

The question is classified as "moderately difficult."

Question 3

No one who has a sore throat need consult a doctor, because sore throats will recover without medical intervention. In recent years several cases of epiglottitis have occurred. Epiglottitis is a condition that begins with a sore throat and deteriorates rapidly in such a way that the throat becomes quite swollen, thus restricting breathing. Sometimes the only way to save a patient's life in these circumstances is to insert a plastic tube into the throat below the blockage so that the patient can breathe. It is highly advisable in such cases that sufferers seek medical attention when the first symptoms occur, that is, before the condition deteriorates.

Which one of the following is the best statement of the flaw in the argument?

(A) The author draws a general conclusion on the basis of evidence of a particular instance.
(B) The author assumes that similar effects must have similar causes.
(C) The author uses a medical term, "epiglottitis," and does not clarify its meaning.
(D) The author makes two claims that contradict each other.
(E) The author bases her conclusion at the end of the passage on inadequate evidence.

Explanation for Question 3

This question requires the test taker to identify the reasoning error in the argument.

The argument states initially that "no one who has a sore throat need consult a doctor." However, it is then pointed out that "several cases of epiglottitis have occurred" and argued that for this condition, which begins with a sore throat and then deteriorates, it is "highly advisable" for sufferers to seek medical attention before the condition deteriorates, that is, when the symptom is a sore throat. So the author claims both that no one with a sore throat need seek medical attention and that some people with a sore throat do need to seek medical attention, and these claims contradict each other. Therefore, (D) is the credited response.

Response (A) is incorrect because the author does not clearly draw "a general conclusion on the basis of evidence of a particular instance" of anything. Even though a specific disease (epiglottitis) is discussed, no conclusion about diseases in general is drawn. And having this disease is discussed in terms of "several cases" and "sometimes," not in terms of a "particular instance."

Response (B) is incorrect because the author is not concerned with the causes of sore throats and epiglottitis.

Response (C) is incorrect because the meaning of the medical term "epiglottitis" is specified in the third and fourth sentences of the passage in sufficient detail for purposes of the argument.

Response (E) is incorrect because the evidence given in the third and fourth sentences of the passage is adequate for the conclusion that "it is highly advisable" in cases of epiglottitis "that sufferers seek medical attention when the first symptoms first occur."

This test question is classified as "very easy."

Question 4

Photovoltaic power plants produce electricity from sunlight. As a result of astonishing recent technological advances, the cost of producing electric power at photovoltaic power plants, allowing for both construction and operating costs, is one-tenth of what it was 20 years ago, whereas the corresponding cost for traditional plants, which burn fossil fuels, has increased. Thus, photovoltaic power plants offer a less expensive approach to meeting demand for electricity than do traditional power plants.

The conclusion of the argument is properly drawn if which one of the following is assumed?

(A) The cost of producing electric power at traditional plants has increased over the past 20 years.
(B) Twenty years ago, traditional power plants were producing 10 times more electric power than were photovoltaic plants.

(C) None of the recent technological advances in producing electric power at photovoltaic plants can be applied to producing power at traditional plants.
(D) Twenty years ago, the cost of producing electric power at photovoltaic plants was less than 10 times the cost of producing power at traditional plants.
(E) The cost of producing electric power at photo-voltaic plants is expected to decrease further, while the cost of producing power at traditional plants is not expected to decrease.

Explanation for Question 4

This question requires the test taker to identify an assumption that would allow the argument's conclusion to be properly drawn. As the argument is stated, there is a logical gap between the information given in the premises and the claim made in the conclusion:

Premise 1: The cost of producing electric power at photovoltaic power plants is one-tenth of what it was 20 years ago.

Premise 2: The corresponding cost for traditional plants has increased.

Conclusion: Photovoltaic power plants offer a less expensive approach to meeting demand for electricity than do traditional power plants.

From the fact that one cost has gone down while another has risen, it does not necessarily follow that the first is now lower than the second. In particular, if the cost of producing electric power at photovoltaic power plants twenty years ago was more than ten times the corresponding cost for traditional plants, then the fact that it is now one-tenth what it was is not sufficient to show that it is now lower than the corresponding cost for traditional plants, even though we are told in Premise 2 that the cost for traditional plants has increased. To conclude from the premises given in the argument that photovoltaic power plants now offer a less expensive approach than do traditional power plants, we need to know how the costs of the two methods of production were related 20 years ago—specifically that the cost of producing power at photovoltaic plants was less than 10 times the cost of producing it at traditional plants. (D) gives this information and is, thus, the credited response.

Response (A) is incorrect because it tells us about only one of the two costs, not about how the two were related 20 years ago. It in effect restates premise 2, and premises 1 and 2 together are not sufficient for drawing the conclusion.

Response (B) is incorrect. The amount of electricity produced by the different kinds of plants is not at issue.

Response (C) is incorrect. While it is relevant to the discussion, (C) does not provide the information about the comparative costs of the two kinds of plants 20 years ago that allows the conclusion to be properly drawn.

Response (E) is incorrect because the conclusion in the argument is about the present only. Whether or not the change described in (E) is expected to take place has no bearing on the claim in the conclusion that the one kind of plant offers a less expensive approach at present.

This question is classified as “difficult.”

Question 5

Some legislators refuse to commit public funds for new scientific research if they cannot be assured that the research will contribute to the public welfare. Such a position ignores the lessons of experience. Many important contributions to the public welfare that resulted from scientific research were never predicted as potential outcomes of that research. Suppose that a scientist in the early twentieth century had applied for public funds to study molds: who would have predicted that such research would lead to the discovery of antibiotics—one of the greatest contributions ever made to the public welfare?

Which one of the following most accurately expresses the main point of the argument?

(A) The committal of public funds for new scientific research will ensure that the public welfare will be enhanced.
(B) If it were possible to predict the general outcome of a new scientific research effort, then legislators would not refuse to commit public funds for that effort.
(C) Scientific discoveries that have contributed to the public welfare would have occurred sooner if public funds had been committed to the research that generated those discoveries.
(D) In order to ensure that scientific research is directed toward contributing to the public welfare, legislators must commit public funds to new scientific research.
(E) Lack of guarantees that new scientific research will contribute to the public welfare is not sufficient reason for legislators to refuse to commit public funds to new scientific research.

Explanation for Question 5

This question requires the test taker to determine the most accurate expression of the main point of the argument in the passage. The main point of an argument is not only a salient point, but one which draws on the rest of the argument for support. The primary purpose of an argument such as that in the passage on which this question is based is to convince the reader to accept the main point.

The passage begins by stating the position that some legislators hold. These legislators “refuse to commit public funds for new scientific research if they cannot be assured that the research will contribute to the public welfare.” Then a reason is given for rejecting this position. Many important contributions to the public welfare come from scientific research for which no assurance could be given of a contribution to public welfare. These contributions “that resulted from scientific research were never predicted as potential outcomes of that research.” Finally, this reason is emphasized by giving an example.

Clearly the purpose of this argument is to refute the position of the legislators mentioned. The main point is the denial of that position. Since response (E) most accurately expresses the denial of the legislators’ position, it is the correct answer.

Response (A) is incorrect because it expresses a point that the argument does not make. Nothing is expressed or implied about whether committing public funds for new scientific research ensures that public welfare will be enhanced. All that is said is that legislators ought not to insist on assurances of enhanced public welfare before committing public funds for new scientific research.

Response (B) is incorrect because it is a prediction of what legislators would do in cases where it is possible to predict the outcome of scientific research. The argument states what the legislators would not do if they cannot be assured that the research will contribute to the public welfare. Moreover, nothing is stated or implied about what legislators would do, the issue is rather what legislators should do. (B) implies that if it is possible to predict a negative outcome of a new scientific research effort, then legislators would not refuse to commit public funds for that effort. Nothing in the argument suggests anything close to this.

Response (C) is incorrect because it speculates that scientific discoveries that have contributed to the public welfare would have occurred sooner if public funds had been committed to the underlying research. Response (C) takes the argument much further than it has committed itself—the issue of whether any discoveries may have occurred sooner

is never addressed within the argument.

Response (D) is incorrect because it addresses an issue that is not discussed in the argument. The argument does not say that the existence of research contributing to the public's welfare is conditional upon legislators committing public funds to that research.

This question is classified as "easy."

Five Sample Reading Comprehension Questions and Explanations

Directions: Each set of questions in this section is based on a single passage or a pair of passages. The questions are to be answered on the basis of what is stated or implied in the passage or pair of passages. For some of the questions, more than one of the choices could conceivably answer the question. However, you are to choose the best answer; that is, the response that most accurately and completely answers the question, and blacken the corresponding space on your answer sheet.

Passage for Questions 1-5

Until recently, many biologists believed that invertebrate "schools" were actually transient assemblages, brought together by wind, currents, waves, or common food sources. Jellyfish groupings, for example, cannot be described as schools—cohesive social units whose members are evenly spaced and face the same way. However, recent research has found numerous cases in which crustaceans and other invertebrates form schools as fish do. Schooling crustaceans such as krill regularly collect in such massive numbers that they provide abundant food for fish, seabirds, and whales.

Like schooling fish, invertebrates with sufficient mobility to school will swim in positions that are consistent relative to fellow school members, and are neither directly above nor directly below a neighbor. The internal structure of such a school changes little with external physical disruption but dramatically with the advent of a predator.

Since schooling is an active behavior, researchers assume that it must bring important benefits. True, schooling would appear to make animals more visible and attractive to predators. However, schooling leaves vast tracts of empty water, thereby reducing a predator's chances of picking up the school's trail. A large group maintains surveillance better than an individual can, and may discourage predation by appearing to be one massive animal. And although an attacking predator may eat some of the invertebrates, any individual school member has a good probability of escaping.

In addition to conferring passive advantages, schooling permits the use of more active defense mechanisms. When a predator is sighted, the school compacts, so that a predator's senses may be unable to resolve individuals, or so that the school can execute escape maneuvers, such as freezing to foil predators that hunt by detecting turbulence. If the predator attacks, the school may split, or may employ "flash expansion"—an explosive acceleration of animals away from the school's center. When large predators threaten the entire school, the school may attempt to avoid detection altogether or to reduce the density of the school at the point of attack; when small predators threaten the margins, school members may put on dazzling and confusing displays of synchronized swimming.

Schooling may also enable invertebrates to locate food—when one group member finds food, other members observe its behavior and flock to the food source. On the other hand, competition within the school for food may be intense: some mysids circle around to the back of the school in order to eat food particles surreptitiously. Schooling can facilitate the search for mates, but as a school's numbers rise, food may become locally scarce and females may produce smaller clutches of eggs, or adults may start to feed on the young. Thus, circumstances apparently dictate the optimal size of a school; if that size is exceeded, some of the animals will join another school.

Question 1

Which one of the following best expresses the main idea of the passage?

(A) The optimal size of a school of invertebrates is determined by many different circumstances, but primarily by issues of competition.
(B) The internal structure of a group of invertebrates determines what defensive maneuvers that group can perform.
(C) Although in many respects invertebrate schools behave in the same way that fish schools do, in some respects the two types of schools differ.
(D) Certain invertebrates have been discovered to engage in schooling, a behavior that confers a number of benefits.
(E) Invertebrate schooling is more directed toward avoiding or reducing predation than toward finding food sources.

Explanation for Question 1

The passage begins by making the point that an earlier view held by biologists—the view that no invertebrates form schools—has been abandoned in the face of evidence that there are numerous cases of invertebrates that do form schools. Evidence that these truly are cases of schooling is presented in the second paragraph. The first sentence of the third paragraph presents the central thesis of the passage, namely, that schooling brings benefits. The rest of the third paragraph focuses mainly on benefits that are enjoyed passively by the school, such as giving the appearance of a single large creature and thereby discouraging predation, while the fourth is concerned with the advantages enjoyed by a school in actively defending itself against predators. The final paragraph turns to potential survival advantages of schooling that are related to feeding and breeding, but it also discusses what may happen when a school gets too large for the available food supply.

(D) is the credited response because, as you can see from the synopsis, the passage begins by making the point that there are invertebrates that form schools. Most of the rest of the passage presents benefits that schooling invertebrates may derive from their schooling behavior. Choice (D) accurately captures both of these aspects of the main point.

Response (A) is incorrect. The passage strongly suggests that the optimal size of a school of invertebrates is determined by how much food is available. But the passage is not primarily concerned with analyzing what determines the optimal size of a school. The passage mentions the issue of optimal size only as part of its discussion of the survival benefits of schooling in the areas of feeding and breeding.

Response (B) is incorrect because the passage discusses defensive maneuvers only as part of its account of one of the benefits of schooling. Thus, how defensive maneuvers work provides evidence for one of the main ideas of the passage, but it is not itself the main focus of the passage. Moreover, (B) does not correctly describe what the passage says about defensive maneuvers. The passage does not relate specific defensive maneuvers to aspects of the internal structure of the school.

Response (C) is incorrect. The passage compares schooling invertebrates to schooling fish only to make the point that their schools have highly similar internal structures. The passage does not mention any dissimilarities between schools of fish and schools of invertebrates. So (C) is not correct.

Response (E) is incorrect. The passage mentions both protection from predation and finding food as benefits that schooling provides for invertebrates, but it does not discuss the issue of the relative importance of these two benefits. So (E) does not describe an idea that can be found in the passage.

This question is classified as “easy.”

Question 2

Which one of the following best describes the final paragraph of the passage?

(A) Arguments for opposing points of view are presented and then reconciled.
(B) The disadvantages of certain types of choices are outlined and alternative choices are proposed.
(C) Two different interpretations of a phenomenon are evaluated and one is endorsed as the more plausible.
(D) The disadvantages of an action are enumerated and the validity of that action is called into question.
(E) Advantages and disadvantages of a behavior are discussed and some actions for avoiding the adverse consequences are mentioned.

Explanation for Question 2

(E) is the correct answer. The final paragraph mentions two advantages of invertebrate schooling behavior, namely, that it enables invertebrates to find food and that it facilitates the search for mates. These advantages can lead to an increase in the size of the school. The downside is that the school can get too large for the local food supply, so that it faces starvation. The paragraph ends by pointing out reactions on the part of the school that have the effect of reducing its size, thereby eliminating the imbalance between population size and food supply. Thus (E) is the correct answer, since it mentions all three salient points: advantages of schooling, disadvantages of schooling, and responses by the school to avoid adverse consequences.

Response (A) is incorrect since the final paragraph is written from only one point of view: the point of view of someone trying to explain that invertebrate schooling behavior is, on balance, of benefit to the invertebrates. There is no mention in this paragraph, or anywhere else in the passage, of any opposing point of view on this matter.

Response (B) is not correct. The final paragraph describes a variety of behaviors on the part of schooling invertebrates. All of these behaviors are best described purely as reactions determined by environmental circumstances, and not as involving any element of choice. But even if one does, metaphorically, call these behaviors "choices," it is not accurate to say that the last paragraph proposes alternative choices.

Response (C) is not correct. It is not clear what it would mean to "interpret" a phenomenon like invertebrate schooling. But, in any case, no alternative interpretation is discussed or evaluated. So (C) fails to be correct for reasons similar to those for which (A) fails to be correct.

Response (D) is incorrect because the final paragraph does suggest that schooling can have the disadvantageous result of making a population too large for the available food supply. But the last paragraph does not question the claim that, overall, schooling is beneficial.

This question is classified as "moderately easy."

Question 3

According to the passage, jellyfish are an example of invertebrates that

(A) do not engage in schooling behavior
(B) form groups with evenly spaced members
(C) assemble together only to feed
(D) form schools only when circumstances are advantageous
(E) collect in such large numbers as to provide abundant food

Explanation for Question 3

(A) is the correct answer. The passage says that jellyfish groupings—and this is the only mention of jellyfish in the passage—"cannot be described as schools" (line 5). Thus, jellyfish are an example of invertebrates that do not engage in schooling behavior.

Response (B) is incorrect. The passage denies that jellyfish groupings are schools (line 5), and immediately goes on to characterize schools as "cohesive social units whose members are evenly spaced." So, the passage presents jellyfish as examples of invertebrates that do not form groups with evenly spaced members.

Response (C) is not correct. The passage does not say that jellyfish are brought together in groups only by the availability of a common food source. The passage also explicitly mentions wind, currents, and waves as giving rise to such groups.

Response (D) is incorrect. As mentioned in the discussion of choice (A), the passage explicitly denies that jellyfish groupings are schools. Thus, since jellyfish do not form schools at all, they are not examples of invertebrates that form schools only when circumstances are advantageous.

Response (E) is incorrect since although the passage does describe krill as collecting in such massive numbers that they provide abundant food, it does not describe jellyfish this way. The passage neither comments on the size of jellyfish groupings nor on whether such groupings are a rich food source for predators.

This question is classified as "easy."

Question 4

It can be inferred from the passage that if cannibalism were occurring in a large school of crustaceans, an individual crustacean encountering the school would

(A) try to stay at the edge of the school in order to obtain food
(B) be more likely to be eaten if it were fully grown
(C) be unlikely to join that particular school
(D) try to follow at the back of the school in order to escape predators
(E) try to confuse school members by executing complex swimming maneuvers

Explanation for Question 4

(C) is the correct answer. The passage makes it clear that the kind of cannibalism that can occur in a school of crustaceans—adults feeding on the young (lines 57–58)—is triggered by scarcity of food. A school that suffers from a shortage of food is not an attractive school for an unattached individual crustacean to join. In fact, such schools are so unattractive that some of their members leave and join other schools (lines 59–60). Thus, the passage provides support for (C).

Response (A) is not correct. According to the passage, cannibalism tends to occur in schools that suffer from a shortage of food. It is unlikely that there would be much food available at the edge of such a school. So it would be highly unlikely that an individual crustacean encountering such a school would attach itself to the edge of that school specifically in order to obtain food.

Response (B) is incorrect. Cannibalism in schools of crustaceans is specifically described as a matter of adults feeding on the young. So it would be reasonable to infer the opposite of (B), namely, that an individual crustacean would be less likely to be eaten if it were fully grown.

Response (D) is incorrect. As the discussion of the correct answer suggests, the most likely reaction on the part of an individual crustacean encountering a school that does not have enough to eat is to avoid that school. As shown by the fact that some members leave a school whose food supply is inadequate, the protection from predation that a school provides is less important than having enough to eat.

Response (E) is not correct since although the passage does mention complex swimming maneuvers executed by members of invertebrate schools, these swimming maneuvers are not presented as a means of confusing members of the school but rather as a means of baffling small predators. So the passage provides no grounds for inferring (E).

This question is classified as "moderately easy."

Question 5

Which one of the following, if true, would most clearly undermine the assumption about schooling mentioned in the first sentence of the third paragraph?

(A) Observation reveals that many groups of invertebrates are unable to execute any defensive maneuvers.
(B) Biologists find that some predators can always tell the difference between a school and a single large animal.
(C) Research demonstrates that the less an invertebrate associates with others of its species, the better its chances of survival.
(D) Biologists confirm that predators are more likely to notice a nearby school of invertebrates than to notice a single invertebrate.
(E) Researchers determine that the optimal school sizes for numerous species have each declined in previous years.

Explanation for Question 5

(C) is the correct answer. The assumption mentioned in the first sentence of the third paragraph is that schooling, since it is an active behavior, must bring important benefits. The rest of the passage makes it clear that the important benefits provided by schooling are those that promote survival. But (C) implies that schooling diminishes an invertebrate's chances of survival. Hence, (C), if true, undermines the stated assumption.

Response (A) is not correct. If (A) said that many groups of schooling invertebrates are unable to execute any defensive maneuvers, then, if true, it would negate one of the benefits claimed for schooling by the passage and thus undermine the assumption to some degree, though perhaps not to the same degree as (C). But in fact (A) says only that many groups of invertebrates are unable to execute such maneuvers, and this does not undermine the assumption at all, since the invertebrates in question may all be of nonschooling varieties. (It is implicit in the first sentence of the second paragraph that some invertebrates lack sufficient mobility to school, and hence, presumably, to execute defensive maneuvers.)

Response (B) is not correct. One important benefit discussed in the passage is the benefit of protection from predation. One of the ways in which schools discourage predation is by appearing to be one massive animal. (B) says that there are some predators that would not be fooled in this way. But even if (B) is true, this mechanism might still discourage a majority of predators. Moreover, this is only one of the ways in which schooling provides protection against predators, and nothing in the passage suggests that it is necessarily even the most important one. So even if (B) is true, schooling would still bring the important benefit of helping to foil predators.

Response (D) is not correct. The passage essentially acknowledges that (D) is true (lines 21–23). However, it suggests that this drawback of schooling is outweighed by the fact that schooling reduces the chances of an encounter between the invertebrates in a school and a predator (lines 23–25).

Response (E) is not correct. The last paragraph indicates that the optimal size of a school depends mainly on the availability of food. So what choice (E) suggests most strongly is that in general there has been a decline in the richness of sources of food. But this does not mean that schools are not an efficient way of exploiting such sources of food as there are, or that they do not confer the other benefits claimed for them, such as protection from predators.

This question is classified as "moderately difficult."