# ACT Test 1 Section 4

**Instructions for Science Reasoning Questions**

Read the passage. For each question, choose the letter on your answer sheet that corresponds to the best answer.

You are not permitted to use a calculator.

**1** Which location in Table 1 has the greatest amount of water vapor in the atmosphere?

- (A) Phoenix, AZ
- (B) San Diego, CA
- (C) Orlando, FL
- (D) Nome, AK

Explanation:
**The correct response is: A**

*The following Practorial may help you answer this question*:

**The Science Reasoning Passages**
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:

**Research Summaries**
- Become Familiar with Experimental Design
- Interpret Experimental Results

Phoenix is the correct answer because although the relative humidity is the highest in Orlando, the absolute humidity is the highest in Phoenix. Relative humidity is the percentage of water vapor present for a given temperature and pressure. So, Orlando has a very high percentage of water vapor relative to the temperature. But, Phoenix has a much higher temperature and the atmosphere can hold more water vapor. The density of water vapor (absolute humidity), or the exact quantity of water per volume, is highest in Phoenix.

**2** At which two locations would the poorest rate of evaporation occur?

- (F) Phoenix and Orlando
- (G) Nome and San Diego
- (H) Nome and Orlando
- (J) Newark and San Diego

Explanation:
**The correct response is: H**

*The following Practorial may help you answer this question*:

**The Science Reasoning Passages**
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:

**Research Summaries**
- Become Familiar with Experimental Design
- Interpret Experimental Results

Nome and Orlando have the highest relative humidity; thus poor evaporation would take place. Evaporation would be at a minimum because the atmosphere is already holding a great deal of moisture (for those temperatures) and is virtually unable to evaporate and hold any more water vapor.

**3** Determine the Humiture index for Denver, Colorado and Cortez, Colorado using the following humidity data:

| Location | Relative Humidity |
|---|---|
| Denver, Colorado | 40 |
| Cortez, Colorado | 80 |

Ⓐ 40 and 80
Ⓑ 90 and 86
Ⓒ 88 and 98
Ⓓ 108 and 82

Explanation:
**The correct response is: C**

*The following Practorial may help you answer this question*:
- **The Science Reasoning Passages**
- Develop an Approach to Solving Problems

*Need to review the basics? These Micro skills are tested in this question*:
- **Research Summaries**
- Become Familiar with Experimental Design
- Interpret Experimental Results

You can find the temperature for Denver (90 degrees) and Cortez (86 degrees) by looking at Figure 1. Then, using the relative humidity data (from Table 3), you can find the Humiture index using Table 2. The temperature in Denver would feel cooler because it is drier than in Cortez, even though Denver's actual temperature is higher.

**4** Based on the passage, what conclusion could be made about the effect of temperature on the humidity?

Ⓕ The temperature does not affect the humidity.
Ⓖ The temperature affects only the relative humidity.
Ⓗ The temperature affects only the absolute humidity.
Ⓙ The temperature affects both the absolute and relative humidity.

Explanation:
**The correct response is: J**

*The following Practorial may help you answer this question*:
- **The Science Reasoning Passages**
- Apply Science Reasoning to Parallel Situations

*Need to review the basics? These Micro skills are tested in this question*:
- **Research Summaries**
- Become Familiar with Experimental Design
- Interpret Experimental Results

The temperature has a strong influence on the absolute and relative humidity. The relative humidity is a measurement of how much water vapor the atmosphere can hold at a certain temperature. The absolute humidity is a measurement of water vapor per volume in the air. The amount of water vapor per volume will be determined by the temperature. Higher temperatures can hold more water vapor.

**5** Based on the passage, what would happen to the relative humidity if the temperature increased and the amount of water vapor in the air remained constant?

Ⓐ The relative humidity would decrease and the absolute humidity would remain constant.
Ⓑ The absolute humidity would decrease and the relative humidity would remain constant.
Ⓒ Both would remain constant.
Ⓓ Both would increase.

Explanation:
**The correct response is: A**

*The following Practorial may help you answer this question*:
- **The Science Reasoning Passages**
- Apply Science Reasoning to Parallel Situations
- Ignore Irrelevant Data

*Need to review the basics? These Micro skills are tested in this question*:
- **Research Summaries**
- Become Familiar with Experimental Design
- Interpret Experimental Results

The absolute humidity would remain constant, because even though the temperature is higher, the amount of water vapor remains constant. This seems to contradict question 4 in the previous passage, but just because the temperature *can* hold more water vapor, does not mean that it *will*. The relative humidity would go down because the temperature had increased; the atmosphere can hold more moisture, so the relative humidity is not as high as it was.

**6** At which place would the highest amount of water vapor most likely be located?

F On a cool beach in autumn
G In a blizzard
H In an office building
J On a hot, humid lakeshore in the summer

Explanation:
**The correct response is: J**

*The following Practorial may help you answer this question*:
**Science Reasoning Tools**
- Apply Science Reasoning to Parallel Situations
- Ignore Irrelevant Data

*Need to review the basics? These Micro skills are tested in this question*:
**Research Summaries**
- Become Familiar with Experimental Design
- Interpret Experimental Results

The answer is **J** because a cool beach in autumn and an office building would not have very much moisture. A blizzard, although very wet and having a high relative humidity, contains very little water vapor due to the cold temperatures. Remember, the relative humidity does not measure the amount of water vapor; it only measures the percentage of moisture present at a certain temperature.

**7** Why was the protein initially purified from the cell media?

A It was membrane bound and portions of the membrane were left in the media.
B The cell excreted the protein into the media.
C The protein was inactive inside the cell but became activated after excretion into the media.
D The media was the easiest fraction to purify.

Explanation:
**The correct response is: B**

*The following Practorial may help you answer this question*:
**Science Reasoning Tools**
- Ignore Irrelevant Data

**The Science Reasoning Passages**
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
**Research Summaries**
- Become Familiar with Experimental Design
- Interpret Experimental Results

The protein was believed to be excreted into the media. In experiment 1, cell media prevented the HIV infection, thus the molecule had been excreted into the media. Choice **A** is incorrect because the text did not discuss cell lysis or membrane portions in the media, it only stated that the molecule must first pass through the membrane. Choice **C** is incorrect because protein activation or inactivation was never discussed. For choice **D**, while the media may have been the easiest to purify, no mention was made for other sources of the protein.

**8** What was the motivation for experiment 1?

F To determine if HIV virus was in the media
G To determine if T cells could be infected with rhinovirus
H To determine if the protein excreted in the media could prevent HIV infection
J To determine the concentration of the protein in the media

Explanation:
**The correct response is: H**

*The following Practorial may help you answer this question*:
**The Science Reasoning Passages**
- Learn About the Test Format
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
**Research Summaries**
- Become Familiar with Experimental Design
- Interpret Experimental Results

Experiment 2 confirmed the hypothesis that the molecule was excreted into the media thus, choice **H** is correct. Since you know that the cell media was a source of the molecule, you know that it prevents the spread of HIV because it blocks the protein coat of the infected cell. This means the HIV-infected cell cannot replicate.

**9** Why were different volumes of concentrated media used in Experiment 1?

- (A) To approximate the effectiveness of the concentrate
- (B) To determine the amount of HIV virus
- (C) To determine the number of cells needed for HIV infection
- (D) To determine the protein concentration of the media

Explanation:
**The correct response is: A**

*The following Practorial may help you answer this question*:
- **The Science Reasoning Passages**
- Learn About the Test Format
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
- **Research Summaries**
- Become Familiar with Experimental Design
- Interpret Experimental Results

The different volumes were used to approximate the effectiveness of the concentrated media and to determine how concentrated it must be to be effective. Choice **B** is incorrect because the concentration of the HIV virus was not determined. Neither the number of cells nor the protein concentrations were determined, thus choices **C** and **D** are incorrect. **A** is the only choice supported by the text.

**10** Why did the scientist separate the cell media into different fractions and assay the fractions individually?

- (F) Small amounts of cell media were needed to prevent HIV infection.
- (G) Chromatography increased the effectiveness of the molecule.
- (H) Only molecules of specific molecular weights could be assayed.
- (J) Isolation of the exact molecule for the cell media allowed it to be identified and studied individually.

Explanation:
**The correct response is: J**

*The following Practorial may help you answer this question*:
- **The Science Reasoning Passages**
- Learn About the Test Format
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
- **Research Summaries**
- Become Familiar with Experimental Design
- Interpret Experimental Results

The scientist was trying to isolate the molecule which prevented infection to later study it, therefore, **J** is the correct choice. The amount of cell media needed to prevent infection does not help in isolating the molecule, so choice **F** is incorrect. Chromatography, choice **G**, was one of the tools used to measure effectiveness; it does not increase or decrease anything in the experiment. The molecular weights, choice **H**, were determined after the fractions were separated, and no previous data support the limitations of only assaying molecules of a particular weight.

**11** Which conclusion can be drawn from Experiment 3?

- (A) The 46 kD molecules may contain two sub-unit molecules of 23 kD each which bind to HIV.
- (B) Non-protein molecules are as effective as the 46kD molecules in preventing HIV infection.
- (C) Binding assays are not effective in determining the ratios of proteins needed to prevent HIV infection.
- (D) Gel electrophoresis can be used to separate protein fractions.

Explanation:
**The correct response is: A**

*The following Practorial may help you answer this question*:
- **The Science Reasoning Passages**
- Learn About the Test Format
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
- **Research Summaries**
- Become Familiar with Experimental Design
- Interpret Experimental Results

Since twice as much of the 23kD protein was needed to bind the virus, one might expect the 46kD molecule to have 2 -23kD sub units. Non-protein molecules did not prevent HIV infections to any extent so choice **B** is wrong. The binding assays *were* effective in determining the ratios, so eliminate choice **C**. Finally, while the gel electrophoresis *was* used to separate the fractions **D**, this was done in experiment 2. Choice **A** is correct.

**12** The motivation for Experiment 2 was

- (F) to determine whether column chromatography had any effect on the HIV virus.
- (G) to determine whether fractionalizing the virus was effective in killing it.
- (H) to isolate and separate protein fractions based on size in order to characterize them.
- (J) to compare the effectiveness of gel electrophoresis with column chromatography.

Explanation:
**The correct response is: H**

*The following Practorial may help you answer this question*:

**Science Reasoning Tools**
- Ignore Irrelevant Data

**The Science Reasoning Passages**
- Learn About the Test Format
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:

**Research Summaries**
- Become Familiar with Experimental Design
- Interpret Experimental Results

Column chromatography was used to separate cell media into fractions that could then be studied by size (and later, by molecular weight, which was done in experiment 3). This fractionalizing was not itself a potential means to fight the virus (choice **G**), neither was column chromatography, which is a measure, not a potential means to prevent the virus from binding to the receptor (choice **F**). No comparisons are made between gel electrophoresis and column chromatography, choice **J**.

**13** What is the order of experimental conditions of solvent and catalyst which gives the highest to lowest yields of product?

- (A) Acid > acid solvent + nickel > acid/acetone solvent + nickel > acid/acetone + cadmium
- (B) Acid solvent + nickel > acetone/acid solvent + nickel > acid solvent > acid/acetone solvent + cadmium
- (C) Acid/acetone solvent + cadmium > acid/acetone solvent + nickel > acid solvent + nickel > acid solvent
- (D) Acid/acetone solvent + nickel > acid/ acetone solvent + cadmium > acid solvent + nickel > acid solvent

Explanation:
**The correct response is: D**

*The following Practorial may help you answer this question*:

**Science Reasoning Tools**
- Apply Science Reasoning to Parallel Situations

**The Science Reasoning Passages**
- Learn About the Test Format
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:

**Research Summaries**
- Become Familiar with Experimental Design
- Interpret Experimental Results

The highest yield was obtained with the acid/acetone solvent and the nickel catalyst (7.5 mg). The other conditions produced the following yields: acid/acetone + cadmium (5.0 mg), acid solvent + nickel (2.5 mg), and acid solvent (1.0 mg).

**14** Which conditions produced the highest number of polymers of length 10 or greater?

- (F) Acid solvent
- (G) Acid solvent + nickel
- (H) Acid/acetone solvent + nickel
- (J) Acid/acetone solvent + cadmium

Explanation:
**The correct response is: J**

*The following Practorial may help you answer this question*:

**The Science Reasoning Passages**
- Learn About the Test Format
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:

**Research Summaries**
- Become Familiar with Experimental Design
- Interpret Experimental Results

The number of polymer of length 10 or greater can be calculated by multiplying the % by the weight produced. Thus:

| | |
|---|---|
| acid solvent | 10% × 1 mg = 0.1 mg |
| acid solvent + nickel | 20% × 2.5 mg = 0.5 mg |
| acid/acetone solvent + nickel | 20% × 7.5 mg = 1.5 mg |
| acid/acetone solvent + cadmium | 80% × 5.0 mg = 4.0 mg |

The acid/acetone solvent with the cadmium produced the most polymers of length 10 or more.

**15** In comparison to the other yields, what yield would you predict under the condition of acid solvent + cadmium?

- (A) Between 2.5 mg and 5.0 mg
- (B) Between 1 mg and 2.5 mg
- (C) Between 5.0 mg and 7.5 mg
- (D) Greater than 7.5 mg

Explanation:
**The correct response is: B**

*The following Practorial may help you answer this question*:
- **Science Reasoning Tools**
  - Apply Science Reasoning to Parallel Situations
- **The Science Reasoning Passages**
  - Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
- **Research Summaries**
  - Become Familiar with Experimental Design
  - Interpret Experimental Results

The cadmium catalyst in the acid/acetone solvent (5 mg) produced less polyacetal than the nickel catalyst with the acid/acetone solvent (7.5 mg). The nickel catalyst in the acid solvent (2.5 mg) produced more polyacetal than the acid solvent alone (1 mg). Therefore, you may conclude that the cadmium catalyst in the acid solvent would produce more that the acid solvent (greater than 1 mg) but less than the nickel catalyst with the acid solvent (less than 2.5 mg).

**16** The surface area of the nickel beads was 10 times greater than the surface area of the cadmium sheet. If the surface area of the catalyst was found to be important in determining the reaction rate and product outcome, then what statement is most likely to be true?

- (F) Using cadmium beads would increase the productions of polyacetal.
- (G) Using a nickel sheet would increase the production of polyacetal.
- (H) Using cadmium beads would decrease the production of polyacetal.
- (J) Using a zinc sheet would decrease the production of polyacetal.

Explanation:
**The correct response is: F**

*The following Practorial may help you answer this question*:
- **The Science Reasoning Passages**
  - Learn About the Test Format
  - Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
- **Research Summaries**
  - Become Familiar with Experimental Design
  - Interpret Experimental Results

The surface of the nickel was greater than the cadmium. The nickel (7.5 mg) produced a greater yield than the cadmium (5.0). Cadmium beads would increase the surface area by 10 times, and increase the yield by 10 times (5 mg)(10) = 50 mg. A nickel sheet would decrease the nickel surface area by 10 times, and thus yield (7.5)/10 = 0.75 mg. Zinc is not used in these experiments and thus no data is given to support choice **J**.

**17** Compare the effects of the overall use of the catalyst and solvent changes on the production of polyacetal polymers.

- (A) The solvent change increased production, but the catalyst decreased it.
- (B) The solvent change decreased production, but the catalyst increased it.
- (C) The solvent change increased production, and so did the catalyst.
- (D) The solvent change and catalyst both decreased production.

Explanation:
**The correct response is: C**

*The following Practorial may help you answer this question*:
- **The Science Reasoning Passages**
  - Learn About the Test Format
  - Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
- **Research Summaries**
  - Become Familiar with Experimental Design
  - Interpret Experimental Results

Compared to the acid solvent alone (1 mg), the addition of the nickel catalyst increased the production of polyacetal (2.5 mg). In addition, the change in solvent from acid to acid/acetone (both in the presence of nickel) increased the production from 2.5 mg to 7.5 mg. Thus both the solvent change and the catalyst increased the production, and choice **C** is correct.

**18** The largest polymer chain lengths for the polyacetal were produced by

- F using the acid solvent alone.
- G using a combination of acetic acid and acetone with the nickel catalyst.
- H using a combination of acetic acid and acetone with the cadmium sheet catalyst.
- J using a combination of the acid solvent and the nickel catalyst.

Explanation:
**The correct response is: H**

*The following Practorial may help you answer this question*:

**Science Reasoning Tools**
- Ignore Irrelevant Data

**The Science Reasoning Passages**
- Learn About the Test Format
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:

**Research Summaries**
- Become Familiar with Experimental Design
- Interpret Experimental Results

As discovered in Experiment 3, replacing the nickel catalyst with a cadmium sheet caused a great increase in chain size: 80% had chain lengths of >10, and the remaining 20% had lengths of 8-9. By comparison, the combination of acetic acid and nickel catalyst, like the combination of acetic acid and acetone and nickel catalyst, yielded a product that was only 20% with chains lengths of >10, 25% of 9, 20% of 8, and 3% of 7. The smallest chain lengths were produced with the acid solvent alone: 10% of 10, 15% of 8, and 60% of 7.

**19** It can be inferred from the passage that cosmology is

- A the study of the universe's origin.
- B a study of the structure of the universe as a single, orderly system.
- C the Big Bang theory.
- D the Steady State theory.

Explanation:
**The correct response is: B**

*The following Practorial may help you answer this question*:

**Science Reasoning Tools**
- Apply Science Reasoning to Parallel Situations
- Ignore Irrelevant Data

*Need to review the basics? These Micro skills are tested in this question*:

**Conflicting Viewpoints**
- Analyze and Compare Conflicting Viewpoints
- Recognize Conflicting Viewpoints

The correct answer can be taken directly from the passage; it is answer choice **B**. Answer **A**, the study of the Universe's origin, is known as *cosmogony*. Answers **C** and **D** are two possible theories in cosmology, and not the whole subject of cosmology.

**20** The Big Bang cosmology can be distinguished from the Steady State cosmology by the phrase:

- F "a static, non-evolving universe"
- G "continuous creation of matter"
- H "the galaxies receding from each other"
- J "the universe expanding from an extremely hot and very dense state"

Explanation:
**The correct response is: J**

*The following Practorial may help you answer this question*:

**Science Reasoning Tools**
- Apply Science Reasoning to Parallel Situations
- Ignore Irrelevant Data

*Need to review the basics? These Micro skills are tested in this question*:

**Conflicting Viewpoints**
- Analyze and Compare Conflicting Viewpoints
- Recognize Conflicting Viewpoints

Big Bang cosmology can be distinguished from Steady State cosmology by the phrase "a universe expanding from an extremely hot and very dense state" (**J**). This is the main point made by the Big Bang theory. **F** and **G** are statements made by proponents of the Steady State theory. **H** is a statement common to both theories, and therefore is not a differentiating point.

**21** The Steady State cosmology essentially says

(A) the universe is the same at all times.
(B) there should be microwave background radiation.
(C) galaxies are receding away from each other.
(D) the universe began with a rapid expansion.

Explanation:
**The correct response is: A**

*The following Practorial may help you answer this question*:
**Science Reasoning Tools**
- Apply Science Reasoning to Parallel Situations
- Ignore Irrelevant Data

*Need to review the basics? These Micro skills are tested in this question*:
**Conflicting Viewpoints**
- Analyze and Compare Conflicting Viewpoints
- Recognize Conflicting Viewpoints

This statement (*the universe is the same at all times*) is the essence of the Steady State theory, as can be inferred from the first sentence of the paragraph on theory 2. **B** and **D** are statements proper to the Big Bang theory. **C** is a statement shared by both theories and is not the essence of the Steady State theory.

**22** It is reported that quasars (distant bright galaxies known as quasi-stellar objects) are more numerous at great distances (hence, earlier times). This observation

(F) supports the Steady State theory.
(G) supports the idea of an initial explosion 14 billion years ago.
(H) supports the observation of the cosmic microwave background radiation.
(J) contradicts the predictions of the Steady State theory.

Explanation:
**The correct response is: J**

*The following Practorial may help you answer this question*:
**Science Reasoning Tools**
- Apply Science Reasoning to Parallel Situations
- Ignore Irrelevant Data

*Need to review the basics? These Micro skills are tested in this question*:
**Conflicting Viewpoints**
- Analyze and Compare Conflicting Viewpoints
- Recognize Conflicting Viewpoints

The Steady State theory states that the universe should look the same both in space and time, and hence there should be a homogenous distribution of quasars. Thus, **F** is wrong. **G** and **H** are two independent statements and are neither supported nor contradicted by the report on quasars.

**23** According to the Big Bang theory, the age of the Universe is at least

(A) 14 billion years.
(B) 8 billion years.
(C) 20 billion years.
(D) 6 billion years.

Explanation:
**The correct response is: B**

*The following Practorial may help you answer this question*:
**Science Reasoning Tools**
- Apply Science Reasoning to Parallel Situations
- Ignore Irrelevant Data

*Need to review the basics? These Micro skills are tested in this question*:
**Conflicting Viewpoints**
- Analyze and Compare Conflicting Viewpoints
- Recognize Conflicting Viewpoints

The correct answer, **B**, can be inferred from the statement "...this moment occurred around 14 +/- 6 billion years ago" which refers to the initial expansion giving birth to the universe. One needs to obtain the minimum number consistent with 14 +/- 6 and this minimum number is 14 – 6 = 8 billion years. The universe is at least this old.

**24** It can be inferred from the passage that most astronomers would

- F support both theories.
- G disapprove of the Big Bang theory.
- H approve of the Steady State theory.
- J agree with the Big Bang theory and disagree with the Steady State theory.

Explanation:
**The correct response is: J**

*The following Practorial may help you answer this question*:
- **Science Reasoning Tools**
  - Apply Science Reasoning to Parallel Situations
  - Ignore Irrelevant Data

*Need to review the basics? These Micro skills are tested in this question*:
- **Conflicting Viewpoints**
  - Analyze and Compare Conflicting Viewpoints
  - Recognize Conflicting Viewpoints

The answer can be inferred from the last sentence in the paragraph on Theory 1, as well as from the last sentence in the paragraph on Theory 2. The answer is **J**. Clearly, the author gives more arguments in favor of Theory 1 (the Big Bang) and no arguments against it, and he gives one argument against Theory 2 (Steady State).

**25** According to the Steady State theory, the universe

- A began in a non-violent manner.
- B has existed forever.
- C will end in a Big Bang.
- D None of the above

Explanation:
**The correct response is: B**

*The following Practorial may help you answer this question*:
- **Science Reasoning Tools**
  - Apply Science Reasoning to Parallel Situations
  - Ignore Irrelevant Data

*Need to review the basics? These Micro skills are tested in this question*:
- **Conflicting Viewpoints**
  - Analyze and Compare Conflicting Viewpoints
  - Recognize Conflicting Viewpoints

It can be inferred from the statement, "the universe has looked about the same forever" that the universe has existed forever. The passage contains no material to prove or disprove answers **A** or **C**, and **D** is incorrect because **B** is a valid answer.

**26** Which letter on the phase diagram indicates the pressure and temperature where the material exists in all three phases simultaneously?

- F point F
- G point G
- H point E
- J point H

Explanation:
**The correct response is: H**

*The following Practorial may help you answer this question*:
- **The Science Reasoning Passages**
  - Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
- **Data Presentation**
  - Diagrams
  - Graphs
  - Tables

Point E lies on the intersection of three boundary lines separating solid, liquid, and gas phases, indicating the three phases co-existing. Point F on the phase diagram lies on the boundary line separating solid and liquid phases, indicating that only two phases co-exist, so **F** is incorrect. Choice **G** is incorrect, because point G lies on the boundary line separating liquid and gas phases, indicating that only two phases co-exist. Point H lies in a region in which the material is in the gas phase, hence choice **J** is incorrect.

**27** Based on Table 1 and the phase diagram, which sequence shows the relationship of the densities among solids, liquids, and gases?

- (A) solids>liquids>gases
- (B) liquids>solids>gases
- (C) gases>liquids>solids
- (D) Depends on the pressure and temperature of the phase

Explanation:
**The correct response is: A**

*The following Practorial may help you answer this question*:
- **The Science Reasoning Passages**
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
- **Data Presentation**
- Diagrams
- Graphs
- Tables

Based on the phase diagram, at point A the material is a solid, at point C the material is a liquid, and at point H the material is a gas. Based on Table 1, a solid thus has a greater density than a liquid and a liquid has a greater density than a gas. Choice **B** is false, because a solid (point A) has a greater density than a liquid (point C). **C** is also false, the reverse sequence is true, because based on the phase diagram and Table 1, solids have the greatest densities followed by liquids, and then gases. **D** is incorrect, because no data is given that shows changing the temperature and pressure of a phase affects the density.

**28** How would a chemist adjust the temperature and pressure in order to liquefy the material at point D?

- (F) At constant pressure, decrease the temperature.
- (G) Increase the pressure while increasing the temperature.
- (H) Decrease the pressure while decreasing the temperature.
- (J) Increase the pressure at constant temperature.

Explanation:
**The correct response is: J**

*The following Practorial may help you answer this question*:
- **The Science Reasoning Passages**
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
- **Data Presentation**
- Diagrams
- Graphs
- Tables

Increasing the pressure at constant temperature will move point D straight up into the liquid phase portion of the diagram. Based on the phase diagram, decreasing the temperature at constant pressure would move point D directly left into the solid region; **F** is incorrect. Choice **G** is false, because increasing both pressure and temperature would keep point D in the gas phase (the upper right portion of the phase diagram). **H** is also incorrect. Decreasing both the pressure and temperature would move point D off of the diagram phase.

**29** At which combination of temperature and pressure will the material being studied exist in two phases at the same time?

- (A) T = 50 K, P = 100 atm
- (B) T = 600 K, P > 600 atm
- (C) T = 200 K, P = 550 atm
- (D) T = 150 K, P = 150 atm

Explanation:
**The correct response is: C**

*The following Practorial may help you answer this question*:
- **The Science Reasoning Passages**
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
- **Data Presentation**
- Diagrams
- Graphs
- Tables

Choice **A** can be eliminated, because at point T = 50 K and P = 100 atm, the material is in the solid phase region of the diagram. Choice **B** is false, since T = 600 K and P > 600 is beyond the scope of the diagram and not accurately interpreted. Choice **C** is the correct response, because the point at T = 200 K and P = 550 atm is F, which lies on the boundary line separating two phases, solid and liquid. This indicates that the material co-exists as a solid and a liquid under these conditions. **D** is incorrect, because at T = 150 K and 150 atm, three boundary lines meet indicating that three phases co-exist.

**30** At which point, A or B, is the material in a more stable phase?

F Point A is more stable because it is a solid.
G Point B is more stable because it is soft.
H Point A is more stable because it exists at a higher pressure.
J The stabilities cannot be compared based on the information given.

Explanation:
**The correct response is: J**

*The following Practorial may help you answer this question*:
**The Science Reasoning Passages**
- Science Reasoning Tools

*Need to review the basics? These Micro skills are tested in this question*:
**Data Presentation**
- Diagrams
- Graphs
- Tables

The passage and the phase diagram indicates that both points A and B are in solid regions of the phase diagram, hence **F** is false. Choice **G** is incorrect, because the passage gives no data to indicate that a material's softness or hardness implies its stability or instability. Choice **H** is also false, for the reason that no data is shown which indicates that a higher pressure means greater stability. **J** is the best choice, because, based on the information presented, one cannot compare the stabilities of the two solids.

**31** From the data given in Table 1, the energy of activation (ΔH) of the substances

A increases as the number of hydrogen bonds increases.
B decreases as the number of hydrogen bonds increases.
C is independent of the number of hydrogen bonds.
D cannot be determined from this data.

Explanation:
**The correct response is: A**

*The following Practorial may help you answer this question*:
**The Science Reasoning Passages**
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
**Data Presentation**
- Diagrams
- Graphs
- Tables

Glycerol has six hydrogen bonds and propanol has two. ΔH for propanol is 4.5 kcal/mole. Intermediate numbers of hydrogen bonds have intermediate values for ΔH. Answer (B) is incorrect: Table 1 shows an inverse relationshipe between the ΔH and the number of hydrogen bonds (i.e., they are not independent). Answer (D) is incorrect: The energies of activation are given in the table of data.

**32** Refer to Figure 1, which illustrates the concentration of substances on either side of a lipid membrane separating two aqueous compartments. Which of the following statements explains why propanol has a higher concentration than glycerol across the cell membrane?

F Propanol is lipid-insoluble and crosses the membrane via aqueous channels.
G Glycerol is lipid-soluble and remains solubilized within the membrane rather than entering the aqueous phase.
H Choices F and G are both true.
J Neither choice F nor choice G is true.

Explanation:
**The correct response is: H**

*The following Practorial may help you answer this question*:
**The Science Reasoning Passages**
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
**Data Presentation**
- Diagrams
- Graphs
- Tables

Propanol is aqueous soluble. It passes through the lipid bilayer membrane via aqueous channels at some rate, dependent on its relative concentrations inside and outside the membrane, and passes into the intracellular aqueous phase. Answer **G** is also true. Glycerol is lipid-soluble. It enters the lipid layer easily, but it does not leave it easily. It needs to overcome the energy of activation. Therefore, **H** is the best answer, since it allows you to choose both correct answers. Since **H** is true, **J** is false, and by choosing either **F** *or* **G** you would be choosing only half of the correct answer.

**33** Refer to Table 1 and Figure 1. Assume that the concentrations of propanol and 1, 3-propandiol are equal in the left compartment (extracellular fluid). Compared to propanol, the concentration of 1, 3-propandiol in the right compartment (intracellular fluid) would be

Ⓐ higher.
Ⓑ lower.
Ⓒ the same.
Ⓓ cannot be determined

Explanation:
**The correct response is: B**

*The following Practorial may help you answer this question*:
**The Science Reasoning Passages**
- Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
**Data Presentation**
- Diagrams
- Graphs
- Tables

1, 3-propandiol is less hydrophilic than propanol and more lipophilic. The concentration of 1, 3-propanol in the right compartment (extracellular fluid) would be lower than that of propanol, because to enter the right compartment (intracellular fluid), its higher energy of activation would have to be overcome. Therefore, choice **B** is correct. Choice **A** is incorrect, because of the reasoning for choice **B**. Choice **C** is incorrect. Their energies of activation are not the same. Choice **D** is false, since the information needed can be obtained from Table 1 and Figure 1.

**34** Compared to water-soluble substances, such as glycerol and ethylene glycol, penetration of ethers, ketones, and aldehydes across lipid membranes

Ⓕ is faster.
Ⓖ is slower.
Ⓗ is at the same rate.
Ⓙ cannot be determined

Explanation:
**The correct response is: J**

*The following Practorial may help you answer this question*:
**The Science Reasoning Passages**
- Ignore Irrelevant Data

*Need to review the basics? These Micro skills are tested in this question*:
**Data Presentation**
- Diagrams
- Graphs
- Tables

None of the data presented here discusses the rate of transport across cell membranes. It only discusses the concentration gradients and potential mechanisms of membrane transit. The correct answer, therefore, is **J**. Since **J** is true, **F**, **G**, and **H** cannot be the right answers.

**35** For lipophilic substances that cross lipid membranes passively, the amount of energy needed to break cohesive bonds is _____ that of hydrophilic substances.

Ⓐ greater than
Ⓑ less than
Ⓒ equal to
Ⓓ cannot be determined

Explanation:
**The correct response is: A**

*The following Practorial may help you answer this question*:
**Science Reasoning Tools**
- Apply Science Reasoning to Parallel Situations

*Need to review the basics? These Micro skills are tested in this question*:
**Data Presentation**
- Diagrams
- Graphs
- Tables

Hydrophilic substances do not form cohesive bonds with lipid membranes. They pass through the lipid layer via aqueous channels. Since **A** is true, choices **B**, **C**, and **D** are not correct.

**36** According to the experimental data, if the distance along the slope is constant, the tension in the rope is proportional to

- Ⓕ the tension of the man.
- Ⓖ the mass of the block.
- Ⓗ the roughness of the slope.
- Ⓙ the angle of the slope.

Explanation:
**The correct response is: G**

*The following Practorial may help you answer this question*:
- **The Science Reasoning Passages**
- ♦ Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
- **Data Presentation**
- ♦ Diagrams
- ♦ Graphs
- ♦ Tables

From *Table 1* you can determine that this experiment details how rope tension is affected by three factors: mass of block, distance and roughness factor. Thus, you can immediately eliminate **F** and **J**. For a specific distance, the roughness factor is constant (for example, it is .001 for 5 meters, and .072 for 20 meters), so you cannot deduce anything about the effects of roughness factor for a specific distance. Therefore, you can eliminate **H**, which leaves you with choice **G**, the correct answer.

**37** According to Table 1, if the mass of the block is held constant, the tension in the rope is proportional to

- Ⓐ the distance of the slope.
- Ⓑ the angle of the slope.
- Ⓒ the strength of the man.
- Ⓓ the roughness factor.

Explanation:
**The correct response is: D**

*The following Practorial may help you answer this question*:
- **The Science Reasoning Passages**
- ♦ Learn How to Use Information in Graphs, Diagrams, and Tables

*Need to review the basics? These Micro skills are tested in this question*:
- **Data Presentation**
- ♦ Diagrams
- ♦ Graphs
- ♦ Tables

According to the table, tension increases with the roughness factor; therefore, **D** is the correct answer. Choices **A**, **B**, and **C** are incorrect.

**38** Assuming a constant mass and roughness factor, if the distance along the slope is increased, which of the following would be expected to occur?

- Ⓕ The tension of the rope would increase.
- Ⓖ The tension of the rope would decrease.
- Ⓗ The tension of the rope stays the same.
- Ⓙ The rope breaks.

Explanation:
**The correct response is: H**

*The following Practorial may help you answer this question*:
- **Science Reasoning Tools**
- ♦ Apply Science Reasoning to Parallel Situations

*Need to review the basics? These Micro skills are tested in this question*:
- **Data Presentation**
- ♦ Diagrams
- ♦ Graphs
- ♦ Tables

As long as the angle of the slope remains the same, the magnitude of the force of kinetic friction will equal the tension at constant speed. Tension would only depend on the mass of the crate and the roughness factor, not the distance. Choice **H** is the best answer.

**39** Which of the following was assumed in the designing of the experiment?

- Ⓐ The length of the rope will influence the tension in the rope.
- Ⓑ The length of the rope will not influence the tension in the rope.
- Ⓒ The mass of the block will not influence the tension in the rope.
- Ⓓ The tension depends on how hard the man pulls.

Explanation:
**The correct response is: B**

*The following Practorial may help you answer this question*:
**The Science Reasoning Passages**
- Apply Science Reasoning to Parallel Situations

*Need to review the basics? These Micro skills are tested in this question*:
**Data Presentation**
- Diagrams
- Graphs
- Tables

As *Table 1* indicates, the experiment tested the effects of three factors on rope tension: mass of block, distance and roughness factor. Because the mass of the block *was* tested, you can eliminate choice **C**. Because the effects of rope length **(A)** and how hard the man pulls **(D)** were not tested, you can narrow your choice to **B**.

Additionally, if you see that two answer choices are direct opposites, like choice **A** and **B** in this question, its very likely that one of them is the correct answer. Using this strategy, you could then have eliminated **C** and **D**, and then considered the factors tested in the experiment to determine whether **A** or **B** was the correct answer.

**40** Which of the following statements summarizes the results of the experiment?

- Ⓕ On a surface which is uniformly rough, tension is proportional to mass.
- Ⓖ Roughness is proportional to distance.
- Ⓗ Mass is proportional to distance.
- Ⓙ Tension is proportional to distance.

Explanation:
**The correct response is: F**

*The following Practorial may help you answer this question*:
**Science Reasoning Tools**
- Ignore Irrelevant Data

*Need to review the basics? These Micro skills are tested in this question*:
**Data Presentation**
- Diagrams
- Graphs
- Tables

Choices **G**, **H**, and **J** are all incorrect. According to the data of the experiment, only **F** is a correct answer. This question asks the same thing as an earlier question, but frames it in a different way.