Psychology and Sociology 3: The Home Stretch

PSYCHOLOGY AND SOCIOLOGY PRACTICE

PASSAGE I (QUESTIONS 1–7)

In 1902, Charles Horton Cooley coined the term "looking-glass self," a social psychological concept stating that a person's self-concept is influenced by interpersonal relationships and the perceptions of others.

In 1976, sociologists Arthur Beaman, Edward Diener, and Soren Svanum performed an experiment on the effect of interpersonal relationships on the self-concepts of children by examining two distinct factors: self-awareness and individuation. The experiment was conducted on Halloween, an event during which, in America, children dress up in costumes and go door-to-door in their neighborhoods to receive candy. The researchers sent 363 children to 18 participating homes. Each time a child rang the doorbell, a woman answered the door, asked the child to pick one piece of candy, and excused herself from the room. The child would be left in the entryway, unaware of an observer hidden behind a festive backdrop. In the self-awareness condition, the entryway of the home contained a mirror placed so the child could see himself taking candy, and observers recorded the child's estimated age, gender, and whether or not he took more than one piece of candy. In the individuation condition, the woman asked the child questions about where the child lived and how old the child was before leaving. Observers in these houses recorded the same information about the children.

Of the 363 children in the study, 70 children transgressed when told not to do so. In both gender groups, fewer boys and girls transgressed when the mirror was present than without (15.6 percent to 35.8 percent and 8.4 percent to 13.2 percent, respectively). It was also found that more children transgressed when they were not asked personal details. Furthermore, it was found that the rate of transgression rose with the age of the child, as can be seen in Figure 1.

Age	Rate of Transgression
1–4	6.5%
5–8	9.7%
9–12	23.6%
13+	41.9%

Figure 1. Ages and transgression rates.

1. The concept of the "looking-glass self" is most related to which of the following sociological paradigms?

A. Social constructionism
B. Symbolic interactionism
C. Functionalism
D. Construct theory

2. If it was found that there was a large degree of imprecision in the estimated ages of the children in the self-awareness group, what effect would this have on the results of the experiment?

A. It would strengthen the hypothesis that all children are equally likely to transgress, regardless of age.
B. It would strengthen the hypothesis that young children develop at different rates.
C. It would weaken the hypothesis that age and rate of transgression are directly proportional.
D. It would have little effect on the overall results, though the study would need to be rerun.

3. Which of the following is true of functionalism?

I. It is a macro-sociological perspective.
II. It focuses on the inequalities between functional societal groups.
III. It maintains that action can be manifest or latent.
A. I only
B. III only
C. I and III only
D. II and III only

4. Suppose that an adult observes one of the children taking extra candy and reasons that the child transgressed because his family is less affluent and is unable to afford many snacks. This is an example of:

A. a consistency cue.
B. the fundamental attribution error.
C. a dispositional attribution.
D. a situational attribution.

5. What purpose did the act of asking the children about their ages and where they lived serve in the experiment?

A. It encouraged the children to see themselves as real people, rather than the personae of their costumes.
B. It was designed to be a qualitative measure of the degree of self-awareness exhibited by the children.
C. It was an attempt to gain demographic information from the children to be used in statistical analysis.
D. It reminded the children of their age and social background, making it more likely that they would transgress.

6. The adult participants in the study, seeing the level of transgression perpetrated by the children in the study, decide to avoid leaving candy out unattended during future Halloween celebrations. This decision is best described as:

A. an adaptive attitude.
B. a social interaction.
C. a social action.
D. a stereotype.

7. The focus and hypotheses of the study are most similar to which of the following?

A. Asch's length of lines study
B. Zimbardo's prison study
C. Milgram's obedience study
D. Sherif's Robbers Cave study

PASSAGE II (QUESTIONS 1–4)

In recent years, there has been a dramatic increase in the number of endurance athletes. People of varying backgrounds have become more involved in endurance sports, like obstacle racing and marathon running. More than 500,000 people complete marathons each year, an increase of more than 200,000 since 1990. Some assert that participation in these activities fulfills certain biological and psychological needs.

Extensive studies show that obesity negatively impacts the health of millions of Americans. As a result, a large segment of our population has shifted their focus toward health and wellness. Examples abound of people who have lost weight and achieved fitness through running marathons. Could the media attention to these stories and to the obesity epidemic be causing an infatuation with endurance sports?

There is no doubt that participation in these sports can have strong health benefits. Combined with proper eating, the process of training for and running a marathon can result in increasing cardiovascular strength, building muscle, and decreasing excess body fat. Yet, when asked about training for a marathon, most runners report that training is far more than developing the physical ability to complete the 26.2-mile foot race. Runners will report the need to develop mental strength to continue running, even when pain and fatigue set in. Despite the pain and fatigue that these athletes experience, that same group will report a strong affinity to the sport. Why would people participate in and enjoy an activity that causes pain? The relationship seems to defy logic for most people, but runners report something entirely different. Running helps them to build a sense of community with other runners, to challenge themselves in ways never thought possible, and to be in control of their own progress and success.

1. The self-determination theory would attribute the rise in the number of endurance athletes to:

A. a response to the biological need for health.
B. the fact that participation in endurance sports builds competence, relatedness, and autonomy, and these factors contribute to a healthy state.
C. more people having physiological and safety needs met and therefore being able to focus on developing a sense of belonging and self-esteem.
D. athletes being extrinsically motivated by media and our society's obsession with fitness.

2. The stressors associated with running a marathon can be numerous. Considering that runners may experience both pain and a sense of accomplishment through running, these stressors are most likely:

A. a positive reappraisal
B. solely distressing for the runners
C. due to the repression of other emotions
D. eustressing and distressing in nature.

3. A woman runs to lose weight and then decides to train for a marathon. After the race, she continues to run even though she no longer needs to lose weight. This woman's actions:

A. were solely externally motivated.
B. were initially motivated extrinsically, but her motivations shifted to both intrinsic and extrinsic motivation.
C. were solely intrinsically motivated.
D. were initially motivated intrinsically, but her motivations shifted to both intrinsic and extrinsic motivation.

4. The sense of belonging, achievement, and control satisfy which level(s) of Maslow's hierarchy of needs?

A. Physiological needs
B. Self-Actualization and Safety and Security
C. Self-Esteem and Love and Belonging
D. Safety and Security and Love and Belonging

PASSAGE III (QUESTIONS 1–6)

The Elaboration Likelihood Model (ELM) is a theoretical framework for examining the strength of a persuasive message. The central route is used by an individual when she is highly invested or motivated in the subject of the argument and is capable of taking the time to think carefully about the message. Not surprisingly, individuals who process an argument centrally are more likely to make changes in their behavior and will resist the fading of new attitudes over time.

The peripheral route is used when individuals are uninterested or unable to fully engage the argument being made. This might result from distraction on the part of the listener, or it might result from what is called low "need for cognition," or a low valuation of engagement in effortful cognitive activities. People using the peripheral route tend to focus on qualities of the presenter, the sheer number of arguments presented, or their own mood when they hear the argument. People using the peripheral route also tend to be susceptible to the "mere exposure effect," a phenomenon by which an argument that is simply presented many times becomes more persuasive as a result of its familiarity. Peripherally processed arguments tend to produce a stronger persuasive effect than centrally processed arguments initially, but fade quickly and lead to little behavior change in the long term.

In 2003, the Centers for Disease Control and Prevention (CDC) implemented a program designed to take advantage of ELM principles to reduce the spread of HIV. The program's first phase focused on the population of individuals in the United States who were identified as living with an HIV-positive diagnosis. The CDC expanded voluntary counseling and testing programs for these individuals in an effort to promote lasting behavioral changes and increase the use of prophylactic prevention and antiretroviral therapy.

1. Which of the following best explains why the CDC would begin its program in the manner described in the passage?

A. HIV-positive individuals are at a higher behavioral risk than the general population.
B. Individuals who agree to voluntary counseling will be more likely make further changes asked of them.
C. The CDC is counting on its credibility with the population in question to increase prevention behaviors.
D. HIV-positive individuals find the CDC's outreach to be more personally relevant.

2. According to the Elaboration Likelihood Model, which of the following best explains the observation that patients on a course of antibiotics often stop taking the drug before the course is over, despite the doctor's instructions to continue taking the pills until they are gone?

A. The doctors have not provided enough reasons to continue the course of the drug once symptoms cease.
B. As patients begin to feel better their motivation to continue taking the drug decreases.
C. Once symptoms are gone, patients reason that their doctors prescribed the wrong amount of the drug.
D. Most patients are aware that overuse of antibiotics can cause drug resistance and be harmful to the population.

3. Suppose that individuals diagnosed with HIV go to a weekly support group. Which of the following social processes would NOT affect the likelihood of treatment compliance?

A. Social facilitation
B. Group polarization
C. Peer pressure
D. Socialization

4. Which of the following concepts is an example of a change in behavior causing a change in attitude?

A. Cognitive dissonance
B. Observational learning
C. The foot-in-the-door phenomenon
D. Attitude change cannot be caused by a change in behavior.

5. A public initiative is aimed at increasing the overall health and fitness of a population. According to the passage, which of the following messages would be useful in persuading an individual with low need for cognition to begin an exercise program?

I. A series of lectures given by medical experts and physically fit celebrities, aired through several media outlets
II. A newspaper article that thoroughly discusses several research findings related to the effectiveness of exercise
III. A 30-second television ad that airs during each commercial break on major networks for three weeks

A. II only
B. I and II only
C. I and III only
D. I, II, and III

6. The CDC wishes to maximize its efforts to increase childhood vaccination. Which of the following programs would best accomplish this goal?

A. Funding government studies providing strong evidence for the effectiveness of childhood vaccination in the prevention of harmful diseases
B. Airing a series of television ads targeted to parents that warn of the risks of childhood illness and use fear as an emotional tool
C. Having experts and celebrities speak at events during which vaccinations can be obtained held at pharmacies typically frequented by families
D. Commissioning posters to be placed in doctors' offices providing statistics that show that the vast majority of young children obtain vaccinations

PASSAGE IV (QUESTIONS 1–5)

The Ultimatum Game is a scenario in which two people are asked to split some amount of money. The first player determines how the money is to be divided, and the second decides whether or not to accept the proposed split. The first player can either split the money in half Fairly (F) or leave a less sizable portion of the money for his partner Unfairly (U). The second player can either Accept (A) or Reject (R) the offer. The "extensive form" of this game, using a total amount of $10 and an example unfair split of $8/$2, can be seen in Figure 1.

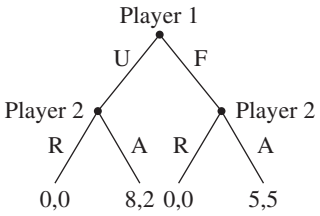


Figure 1. "Extensive form" of the game.

Experimental evidence demonstrates that Player 2 will rarely play optimally, routinely rejecting offers of 30 percent or less. This punishment behavior initially perplexed evolutionary theorists, but can be understood when it is considered that a "game" such as this one is rarely played just once between individuals. In subsequent iterations, Player 1 will tend toward more fair splits, and cooperation develops.

One such variation of the Ultimatum Game is the Big Monkey/Little Monkey game. In this scenario, two monkeys can cooperate to shake a fruit that contains 10 kCal of energy from a branch of a tall tree. Either monkey can choose to climb (C) the tree to help shake the fruit down or to wait (W) on the ground for the fruit to fall. The Big Monkey must expend 2 kCals of energy to climb the tree, while the Little Monkey can do so with negligible energy loss. The Big Monkey is also capable of hogging the fruit and eating more than the Little Monkey, such that if both climb and shake the fruit down together, they will reach the ground at the same time and split the fruit 7:3 in favor of the Big Monkey. If either monkey is waiting on the ground when the fruit falls, it will begin eating while the other monkey is climbing down. The extensive form of these two versions can be seen in Figure 2.

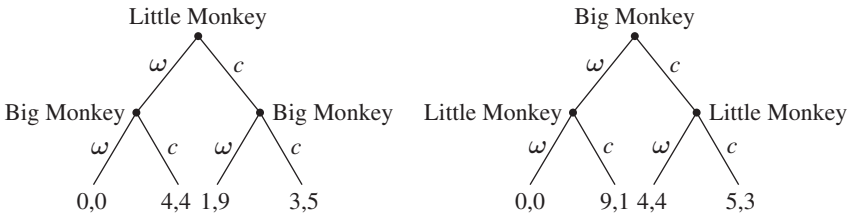


Figure 2. Extensive form of two versions of the game.

1. In the ultimatum game, Player 2's rejection of an $8/$2 split is an example of:

A. spite.
B. selfishness.
C. costly signaling.
D. negative reinforcement.

2. Assuming both monkeys are rational and capable of computing kCal outcomes, which of the following describes the optimal strategy for the Little Monkey when going first and second, respectively?

A. Climb; do the same thing Big Monkey does
B. Climb; wait no matter what Big Monkey does
C. Wait; climb no matter what Big Monkey does
D. Wait; do the opposite of what Big Monkey does

3. In the Big Monkey/Little Monkey game, imagine that both monkeys decide their strategies by flipping a fair coin simultaneously. Which of the following is the expected payout for the Big Monkey?

A. 2
B. 4.5
C. 6.5
D. 9

4. In a social trap, each individual acts in his or her own best interest in the short term, which leads to a loss for the group in the long term. For example, one may hoard water during a drought.Which of the following is true of a community caught in a social trap?

A. The community has lost its sense of Gemeinschaft.
B. The community has lost its sense of Gesellschaft.
C. The individuals are exhibiting the self-serving bias.
D. The individuals are exhibiting the just-world hypothesis.

5. Ecologists observing a population of rhesus monkeys find that members of the population are expected to signal others when they find food, and transgressors are so severely punished by the group that signaling has become an evolutionarily stable strategy. Which of the following is a consequence of this scenario?

A. Individuals in the population have evolved in such a way such that natural selection will prevent individual cheaters from invading the group.
B. An individual rhesus monkey could potentially infiltrate the group and take advantage of the altruism displayed by the population.
C. Altruism can be considered the Nash equilibrium point that describes the optimal strategy for each individual within the population.
D. If disturbed by a change in environment or invasion by another large population of monkeys, the altruism strategy should return through natural selection.

High-Yield Science Wrap-Up

PASSAGE I (QUESTIONS 1–7)

The cornea, at approximately 43 diopters, provides most of the focusing power of the eye, while the lens provides power for fine adjustments. The lens is a transparent, biconvex structure in the human eye that helps to refract light so it can be focused on the retina; it has an approximate refractive index of 1.42. The cornea has a slightly smaller refractive index, at 1.38. When the ciliary muscles are contracted, zonule fibers loosen, allowing the lens to relax to a more convex shape. In contrast, when the ciliary muscles are relaxed, zonule fibers tighten, causing the lens to become less convex. Through this process, the focal length of the lens can be changed to match the object's distance so that a clear, focused image forms on the retina. When relaxed, the lens has a power of 15.8 diopters and is used for objects at infinite distances.

Myopia is an ocular pathology that includes good *near vision* and poorer vision for farther objects. Simple myopia results when the lens is too powerful for the eye's axial length, approximately 17 mm in most adults.

Corrective lenses for myopia diverge the light before it hits the lens, so the image still lies on the retina for faraway objects. Both contact lenses and eyeglass lenses can be used to correct for myopia; however, the distance between lenses needs to be taken into account for eyeglasses when deciding the appropriate corrective power. Eyeglass makers can change the power of lenses by adjusting their shape according to the equation below.

$$\frac{1}{f} = (n - 1)\left(\frac{1}{r_1} - \frac{1}{r_2}\right)$$

In this equation, f is the focal length, n is the refractive index of the lens, r_1 is the external radius of curvature, and r_2 is the internal radius of curvature. The lens maker equation can be used for approximating the power of thick, spherical lenses.

1. For a myopic person with a normal axial length, the image of a star appears 10 mm in front of their retina. When they put on corrective contact lenses, however, the image of the star appears focused. Assuming the distance between lenses is negligible, what is the approximate power of the contact lens?

A. +58.8 diopters
B. −41.2 diopters
C. +29.4 diopters
D. −29.4 diopters

2. If the external radius of curvature of an unaccommodated human lens is 10.2 cm and the internal radius of curvature is −6.0 cm, what is its total power?

A. −0.5 diopters
B. 0.1 diopters
C. −5 diopters
D. 10 diopters

3. What would be the effect of a muscle relaxant applied directly to the ciliary muscles of the eyes for a person with normal vision?

A. They'd have trouble focusing on faraway objects.
B. They'd have trouble focusing on nearby objects.
C. They'd have trouble seeing in the dark.
D. They'd have trouble seeing in bright sunlight.

4. An object sits in front of a glass lens with a power of +5 diopters. The object is moved from a distance of 100 cm to a distance of 5 cm. Describe the change in the image's appearance.

A. It would get smaller, then bigger, then disappear, then get bigger.
B. It would get bigger, then disappear, then get smaller.
C. It would get smaller.
D. It would get bigger.

5. Hyperopia, or farsightedness, is when the lens is too weak and the image focuses behind the retina. Which of the following corrective lenses could be worn to improve hyperopic vision?

A. Wearing glasses thicker in the center and thinner along the edges, to help converge the rays
B. Wearing glasses thinner in the center and thicker along the edges, to help converge the rays
C. Wearing glasses thicker in the center and thinner along the edges, to help diverge the rays
D. Wearing glasses thinner in the center and thicker along the edges, to help diverge the rays

6. Which of the following properties will change as incident monochromatic rays refract from the air into the cornea?

I. Frequency
II. Wavelength
III. Speed
IV. Intensity

A. I, II, and III
B. I, III, and IV
C. I, II, and IV
D. II, III, and IV

7. Which of the following glass lenses could potentially be used to correct myopic vision?

A. External radius of curvature of −15 cm, internal radius of curvature of 10 cm, refractive index of 1.4
B. External radius of curvature of 10 cm, internal radius of curvature of 8 cm, refractive index of 2.4
C. External radius of curvature of 8 cm, internal radius of curvature of −8 cm, refractive index of 1.5
D. External radius of curvature of 10 cm, internal radius of curvature of 10 cm, refractive index of 1.8

PASSAGE II (QUESTIONS 1–5)

Hydrogen gas has a variety of industrial uses. It can be used to produce refined hydrocarbon products from raw petroleum. It enhances the quality of argon-based welding applications. It has the potential to be a fuel for alternative-fuel automobiles, if certain technical hurdles can be overcome.

Hydrogen cannot be mined or refined, however, since it is far too reactive with oxygen gas to be present in significant quantities anywhere in nature. Instead, essentially all hydrogen gas used on the planet has to be created. By far the most common method for making hydrogen gas is the electrolysis of water. A simple apparatus for the electrolysis of water is shown in Figure 1.

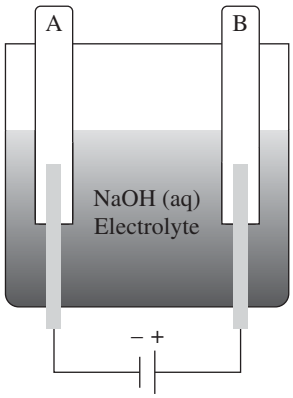


Figure 1. Apparatus for the electrolysis of water.

Two inert metal electrodes are placed in a solution of aqueous inert electrolyte, such as NaOH. The electrodes are attached to the two poles of a power source and current flows through the solution. Test tubes A and B are used to collect the gases, which are the by-products of electrolysis.

The chemical reactions that take place at the anode and cathode, respectively, are:

Cathode: $2\ H_2O(l) + 2e^- \rightarrow H_2(g) + 2OH^-(aq)$ $\quad E^0_{red} = 0.0V$

Anode: $2\ H_2O(l) \rightarrow O_2 + 4\ H^+(aq) + 4\ e^-$ $\quad E^0_{ox} = -1.23V$

1. When the battery is hooked up to the electrolysis cell, what best characterizes what happens?

A. Electrons flow from cathode to anode, and oxygen gas is collected in test tube A.
B. Electrons flow from cathode to anode, and hydrogen gas is collected in test tube A.
C. Electrons flow from anode to cathode, and oxygen gas is collected in test tube A.
D. Electrons flow from anode to cathode, and hydrogen gas is collected in test tube A.

2. What is the role of the NaOH in the electrolysis of water?

A. NaOH provides OH^- ions, a necessary catalyst for the cathodic reaction.
B. NaOH dissociates into ions, which increase conductivity of the water, improving efficiency.
C. NaOH increases the pH of the solution, preventing undesired cross-reactions.
D. NaOH provides OH^- ions, which help limit the rate of the cathodic reaction.

3. If 20A of current flows through a water electrolysis cell for 10 minutes, what is the volume of oxygen generated at the anode, if it is at STP?

A. 45 mL
B. 672 mL
C. 2.69 L
D. 20.0 L

4. Which of the following metals reacts vigorously with water to release hydrogen gas?

A. Mg
B. Au
C. K
D. Al

5. What is the oxidation state of the chromium atoms in the dichromate ion, $Cr_2O_7^{2-}$?

A. −7
B. 0
C. +4
D. +6

PASSAGE III (QUESTIONS 1–6)

Carbon monoxide reacts with nitrogen dioxide according to the following equation:

$CO(g) + NO_2(g) \rightarrow CO_2(g) + NO(g)$ $\Delta H = +33$ kJ/mol

While carbon monoxide, carbon dioxide, and nitric oxide are colorless, nitrogen dioxide is reddish-brown in color. By shining light rays of a specific wavelength and intensity at a colored compound, the concentration of that compound can be determined from its absorbance, the negative logarithm of the transmitted intensity to the incident intensity. A spectrophotometer can be used to measure the rate of a reaction by determining a solution's absorbance at regular intervals.

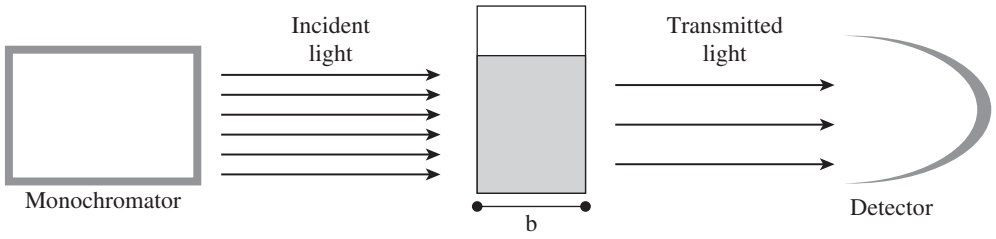


Figure 1. A spectrophotometer.

Beer–Lambert's Law ($A = \varepsilon bc$) shows that A (absorbance of the solution) is equal to b (the length of the measurement cuvette) multiplied by c (the concentration of colored compound in solution) multiplied by ε (the molar extinction coefficient, a constant indicating the absorption strength of the colored compound).

A chemistry student decides to study the kinetics of the above reaction by completing the following experiment. A solution of known NO_2 concentration was measured at 390 nm to determine NO_2's molar extinction coefficient. The ε value was calculated as 5.04×10^2 $cm^{-1}M^{-1}$, the intensity of incident light as 998 W/m^2, and the cuvette length as 1 cm. All subsequent measurements were also taken spectrophotometrically at 390 nm.

In Trial 1, the student adds 10 mols of CO to 5 mols of NO_2 at STP and measures the initial rate of reaction. In Trial 2, the student repeats the experiment at the same temperature, but with twice the initial pressure. In Trial 3, the student adds 30 moles of CO to 5 moles of NO_2 at STP. Table 1 shows the results.

Trial Number	Initial Change in Absorption/ Time (s^{-1})
1	-1.49×10^{-4}
2	-6.04×10^{-4}
3	-1.53×10^{-4}

Table 1. Kinetics experiment results.

1. What would be the effect of increasing temperature after the system reaches dynamic equilibrium?

A. The system would get more red.
B. The system would get less red.
C. The forward rate of reaction would decrease.
D. The reverse rate of reaction would decrease.

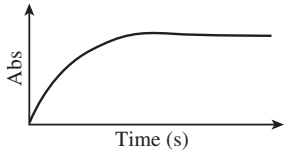
2. What is the best description for this reaction?

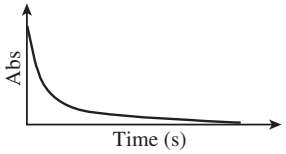
A. Combustion
B. Double-replacement
C. Hydrolysis
D. Redox

3. Based on the passage, which of the following is a reasonable rate law for the reaction?

A. dNO/dt = +5 M-2s-1$[NO_2]^2$
B. dNO/dt = +5 M-2s-1$[NO_2]^2[CO]$
C. dCO_2/dt = +5 M-1s-1$[NO_2]^2$
D. dCO_2/dt = +5 M-3$[NO_2]^2[CO]^2$

4. If the initial concentrations of NO, NO_2, CO, and CO_2 are all 0.1 M, and the K_{eq} for this reaction was 0.5, what would the graph of absorbance *vs.* time look like if we allowed the system to reach equilibrium?

A.


C.


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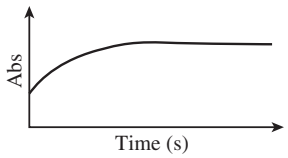

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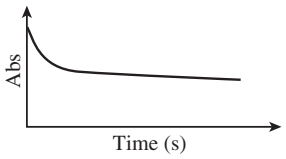


5. A final trial is conducted using unspecified concentrations of NO_2 and CO. If the intensity of light transmitted at t = 0 s is 11 W/m^2 and the intensity of light transmitted at t = 20 s is 102 W/m^2, what is the initial rate of the reaction?

A. Rate = -10^{-3} M s^{-1}.
B. Rate = $+10^{-3}$ M s^{-1}.
C. Rate = -10^{-5} M s^{-1}.
D. Rate = -10^{-4} M s^{-1}.

6. Which of the following conditions is/are *always* true for exothermic reactions?

I. If ΔS is positive, $Q < K_{eq}$.
II. If ΔS is negative, the reaction is spontaneous.
III. If ΔG is positive, $Q < K_{eq}$.
IV. Rate Fwd = Rate Rvs.

A. I, II, and IV
B. II and III
C. II only
D. I only

PASSAGE IV (QUESTIONS 1–4)

Proper functioning of the respiratory system relies on mechanical and chemical mechanisms that allow for the efficient exchange of oxygen and carbon dioxide. The lungs are individually enclosed in fluid-filled sacs, which join the lungs to the chest wall. The alveoli are prone to collapse, due to surface tension from the air-liquid interface. This collapse is prevented by the body's use of a special detergent called a surfactant, which lowers surface tension. Normally, when an alveolus shrinks due to surface tension, the volume of the interstitial space between the alveolus and capillary increases, decreasing pressure in the interstitial space and fluid moving into the space and lung.

In respiratory distress syndrome of the newborn, premature babies are born without the ability to manufacture surfactant. These babies often exhibit collapsed alveoli. The collapse of alveoli increases the energy required to breathe and decreases the surface area through which gases can diffuse. Treatment of these babies often includes administering enough surfactant to prevent alveolar collapse. To determine how much supplemental surfactant these babies require, a scientist conducts an experiment to discover the dependence of alveolar surface area on surface tension within that alveolus. Three samples of lung tissue are placed into three separate dishes. In the first dish, pure water is injected into the lung tissue; the tissue is filled with oxygen gas, then deflated in order to calculate surface tension at different lung volumes. In the second dish, the same procedure is replicated, but Detergent A is added in addition to water. Finally, in the third dish, the same procedure is repeated, but surfactant, instead of Detergent A, is injected into the lung tissue in addition to the water. A force transducer is used to measure surface tension. The results are summarized in Figure 1.

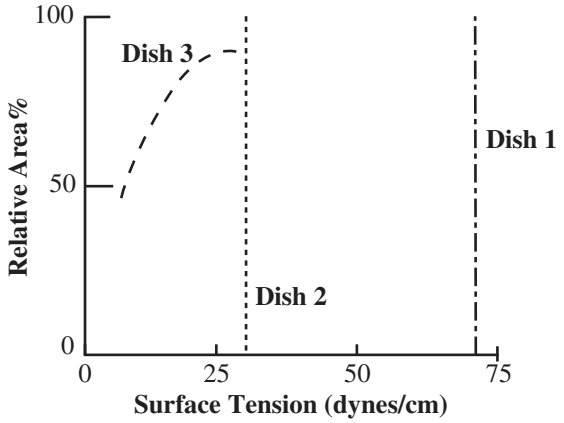


Figure 1. Surface tension results.

1. A premature baby is born without the ability to manufacture sufficient quantities of surfactant, which results in:

A. increased pH in muscles of respiration.
B. lactic acid buildup in muscles of respiration.
C. increased pH in blood leaving the lungs.
D. increased oxygen pressure in blood leaving the lungs.

2. Suppose a fourth dish of lung extract is prepared, but oxygen gas is not used to fill and expand the lung. If the scientist wishes to decrease the surface tension in the lung to a minimum value, oxygen should be replaced with:

A. nitrogen gas.
B. carbon dioxide gas.
C. sodium chloride solution.
D. water containing dissolved oxygen gas.

3. Which of the following explains the biologist's findings regarding the dependence of surface tension on surface area in the second and third dishes?

A. Upon deflation of the lung, the number of Detergent A molecules on the surface of alveolar cells increases.
B. As the surface area of an alveolar cell decreases, surfactant moves from the surface of the cell to the center.
C. Detergent A is hydrophobic and loses its ability to interrupt water's attractive forces as the surface area decreases in the alveolar cell.
D. The ratio of water to surfactant molecules on the surface of an alveolar cell decreases as the surface area of the cell decreases.

4. Fluid buildup in the lungs may impede blood flow, resulting in an immediate increase in blood pressure in the:

A. pulmonary veins.
B. pulmonary arteries.
C. aorta.
D. right atrium.

PASSAGE V (QUESTIONS 1–5)

Proteins have several levels of structural complexity, each of which has important consequences in the protein's physical, chemical, and biological properties. A protein's primary structure is the sequence of covalent peptide bonds connecting amino acid residues, generally expressed starting with the N-terminal residue and ending with the C-terminal residue. Secondary structure deals with the presence of three-dimensional structural elements such as α-helices or β-pleated sheets. These structures are formed by short sections of the primary structural sequence and are held together by hydrogen bonds between amino acid residues. Tertiary structure expresses the complete three-dimensional arrangement of the secondary structural elements across an entire peptide chain. For example, α-helices from different sections of the primary structural sequence may be spatially close together, thus defining a portion of the peptide's tertiary structure. Quaternary structure defines the spatial relationship between two or more polypeptides in a single protein or enzyme.

The geometry of the peptide bond, which is restricted to planar conformations, is an important factor in the formation of secondary and tertiary structure. The planar restriction leads to two possible conformations, called s-*trans* and s-*cis,* shown below:

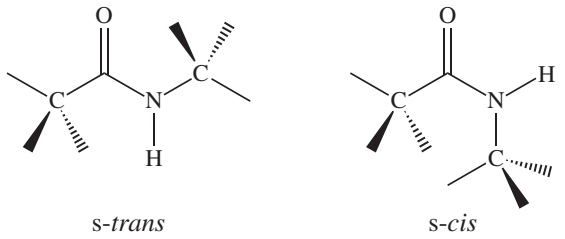
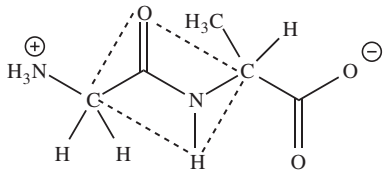


Figure 1. Peptide bonds: s-*trans* and s-*cis* conformations.

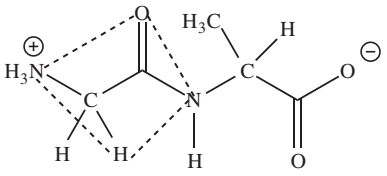
In addition to the peptide bond linking each amino acid residue, disulfide links also play important roles in determining the relationships between amino acid residues defined by secondary, tertiary, and quaternary structure. Disruption of peptide conformations or disulfide links can result in denaturation of the protein.

1. Coplanar atoms in peptide links are often shown by defining the plane which they occupy. Which of the following correctly shows the coplanar atoms in the dipeptide Gly-Ala? (Glycine has a hydrogen atom as a side chain, while alanine has a methyl side chain.)

A.



B.



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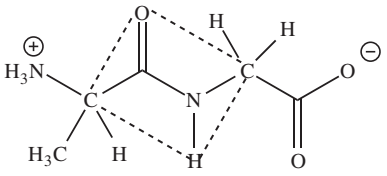
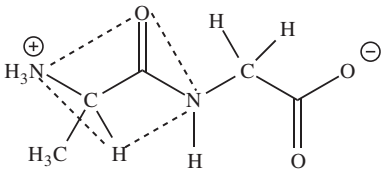


D.



2. Disulfide links can be easily formed, as shown in the following reaction:

$$2\ RCH_2SH + I_2 \rightarrow RCH_2S\text{–}SCH_2R + 2HI$$

In this reaction, the two cysteine residues undergo which type of reaction?

A. Nucleophilic substitution
B. Reduction
C. Nucleophilic addition
D. Oxidation

3. The presence of s-*cis* or s-*trans* peptide links can lead to vastly different structural features in a peptide chain. However, most peptide links in a chain are of the:

A. s-*cis* type, because of its lack of nonbonded strain.
B. s-*cis* type, because of its excess nonbonded strain.
C. s-*trans* type, because of its lack of non-bonded strain.
D. s-*trans*, because of its excess nonbonded strain.

4. A protein is subjected to conditions that cleave all disulfide links. Molecular weight determinations performed on the molecule before and after cleavage yield results that are not significantly different. Which of the following can be concluded?

A. The protein has elements of quaternary structure.
B. The protein does not have elements of quaternary structure.
C. The protein has no quaternary structural elements that depend upon disulfide links.
D. The protein has quaternary structural elements that depend upon disulfide links.

5. Because of the peptide bond restriction to planar conformations, all of the following can be concluded about the atoms in the link EXCEPT:

A. the nitrogen lone pair has π-overlap with the carbonyl π-bond.
B. there is considerable positive-charge character on the nitrogen atom.
C. the nitrogen atom is sp^3 hybridized.
D. there is considerable negative-charge character on the carbonyl oxygen

PASSAGE VI (QUESTIONS 1–4)

Hemoglobin is the protein within erythrocytes that transports oxygen to body tissues. In adults, hemoglobin molecules are composed of two α chains and two β chains ($\alpha_2\beta_2$). Thalassemias are a class of inherited diseases caused by impaired synthesis of hemoglobin subunits. There are two types of thalassemia: thalassemia minor and thalassemia major. Thalassemia minor is found in heterozygotes, who are generally asymptomatic or have mild anemia, and also possess a resistance to malaria. Thalassemia major is found in homozygotes and causes serious symptoms.

α-Thalassemias are caused by deletions of one or more of the α-globin genes in an α-gene cluster. In the most severe form, where the patient is left without any α chains, fetal γ hemoglobin chains and adult β hemoglobin chains form homotetramers (γ_4 or β_4). These abnormal hemoglobin molecules cannot release oxygen under physiological conditions.

Heterozygotes with β-thalassemia are asymptomatic, while homozygotes have severe anemia. When levels of fetal hemoglobin drop, patients often require frequent blood transfusions. Anemia in these patients is due not only to the lack of β-chains, but also to the surplus of α-chains, which precipitate and damage erythrocyte membranes.

β-Thalassemias are generally caused by a diverse set of point mutations that alter β-chain levels. For example, mutations in the β-chain promoter region, nonsense mutations, frameshift mutations, mutations that alter sequences at the intron/exon boundary, and mutations that alter the AAUAAA cleavage signal at the mRNA 3′ end all cause β-thalassemia.

1. A man with thalassemia major marries a woman with thalassemia minor. If they have three children, what is the probability that all three children will have thalassemia major?

A. 12.5%
B. 25%
C. 50%
D. 100%

2. A point mutation in the promoter region of β-genes promoter region would have what effect?

A. Translational repression
B. Transcriptional repression
C. Neither type of repression would result
D. Both types of repression would result

3. In a certain population, 16% of the individuals have thalassemia major. What percentage of this population is heterozygous for the thalassemia gene?

A. 4%
B. 24%
C. 36%
D. 48%

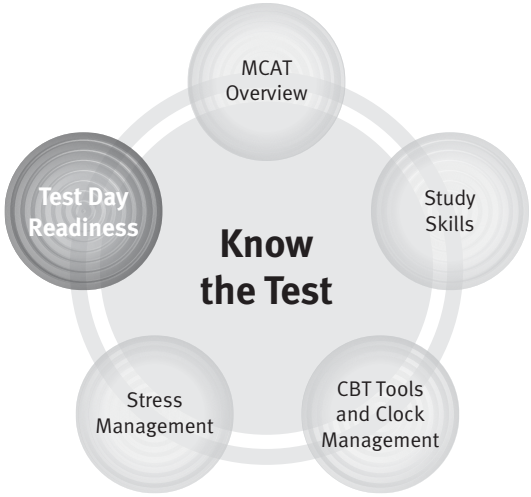
4. Transcriptional repression occurs in what region within the cell?

A. Cytoplasm
B. Ribosomes
C. Rough endoplasmic reticulum
D. Nucleus

Test Day Readiness

In this lesson, you'll learn to:

- Use the time between the end of your class and Test Day efficiently



LESSON 8.5, LEARNING GOAL 1:

- Use the time between the end of your class and Test Day efficiently

Am I ready to take the MCAT?

- Have you completed relevant homework?

- Have you been *consistently* scoring in your desired range on practice tests?

- Are you experiencing understandable nervousness or actual reasons for concern?

- Make sure you talk to Kaplan before you decide to actually reschedule your exam.

Higher Score Guarantee

- You must attend all scheduled classes (and follow guidelines regarding make-up sessions).
- You must take all scheduled practice tests.
- You need to complete the "required" homework for your course *prior* to your course expiration date or exam date, whichever is earlier.
- You need to submit claim for Higher Score Guarantee within 90 days of course expiration date

KAPLAN TIP
The decision about whether you're ready to take your MCAT is a tough one. Make sure you consider it carefully and yet still keep up your confidence!

Update Your Study Calendar

What to include in your calendar:

- Any Remaining Required Work
- Flashcards
- Full-Length Tests
- Section Tests
- Q-Bank
- Additional Resources

Sample Calendars

Case #1: "I am not caught up with my homework from the course"

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Week 4	Complete Remaining Homework from Unit 1	Complete Remaining Homework from Unit 2	Complete Remaining Homework from Unit 2	Complete Remaining Homework from Unit 3	Complete Remaining Homework from Unit 3	Two practice section tests, Flashcards	Day off
Week 3	Lesson Book for weak areas, Flashcards	Review Books for weak areas, Flashcards	Two practice section tests, Flashcards	Take a practice full-length test	Review Test, Flashcards, Q-bank	Day off	Q-bank, Flashcards
Week 2	Lesson Book for weak areas, Flashcards	Take a practice full-length test	Review Test, Flashcards, Q-bank	Review Books for weak areas, Flashcards	Two practice section tests, Flashcards	Day off	Take a practice full-length test
Last Week	Review Test, Flashcards, Q-bank	Two practice section tests, Flashcards	Lesson Book for weak areas, Flashcards	Review Books for weak areas, Flashcards	Q-bank, Flashcards	Day off	**Test Day!**

KAPLAN TIP
Plan your study calendar in detail and stick to it to maintain great study habits all the way to Test Day.

Case #2: "I have a few weaker content areas but have finished all the homework"

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Week 4	Lesson Book for weak areas, Flashcards	Review Books for weak areas, Flashcards	Two practice section tests, Flashcards	Lesson Book for weak areas, Flashcards	Review Books for weak areas, Flashcards	Day off	Take a practice full-length test
Week 3	Review Test, Flashcards, Q-bank	Lesson Book for weak areas, Flashcards	Review Books for weak areas, Flashcards	Two practice section tests, Flashcards	Lesson Book for weak areas, Flashcards	Day off	Take a practice full-length test
Week 2	Review Test, Flashcards, Q-bank	Lesson Book for weak areas, Flashcards	Review Books for weak areas, Flashcards	Two practice section tests, Flashcards	Two practice section tests, Flashcards	Day off	Take a practice full-length test
Last Week	Review Test, Flashcards, Q-bank	Lesson Book for weak areas, Flashcards	Review Books for weak areas, Flashcards	Two practice section tests, Flashcards	Review Books for weak areas, Flashcards	Day off	**Test Day!**

Case #3: "I am feeling pretty confident about the test"

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Week 4	Lesson Book for weak areas, Flashcards	Review Books for weak areas, Flashcards	Two practice section tests, Flashcards	Take a practice full-length test	Review Test, Flashcards, Q-bank	Day off	Review Books for weak areas, Flashcards
Week 3	Two practice section tests, Flashcards	Take a practice full-length test	Review Test, Flashcards, Q-bank	Lesson Book for weak areas, Flashcards	Review Books for weak areas, Flashcards	Day off	Take a practice full-length test
Week 2	Review Test, Flashcards, Q-bank	Lesson Book for weak areas, Flashcards	Review Books for weak areas, Flashcards	Two practice section tests, Flashcards	Two practice section tests, Flashcards	Day off	Take a practice full-length test
Last Week	Review Test, Flashcards, Q-bank	Two practice section tests, Flashcards	Take a practice full-length test	Review Test, Flashcards, Q-bank	Lesson Book for weak areas, Flashcards	Day off	**Test Day!**

Which sample calendar most closely resembles your plans for studying up until Test Day?

Practice Tests: Problems and Solutions

What can I do if I...

...am not finishing every section in time?

...have to constantly refer back to the passage?

...keep narrowing down questions to two choices but pick the wrong answer?

...feel fatigued during the test, especially at the end?

...always end up missing questions on the same topics?

KAPLAN TIP

Not quite getting that goal score yet? Try something different. Use solutions to common practice test issues to break the mold of a scoring plateau.

What to Do…

…until a week before the test

- Focus on weak areas.
- Read, read, read!
- Diagnose yourself with your Practice Test scores and review.
- Address any fatigue or focus issues.
- Don't get so hung up on content that you forget to evaluate things like your pacing, triaging, and endurance.
- Practice at the computer.
- Create test-friendly habits.
- Work carefully with your motivation to make sure you can stick to your study commitments.

…exactly one week before Test Day

- Get up at the same time you would on Test Day.
- Visit the test site.
- Start going to bed at an appropriate time.
- Take a practice full-length test.

…during the week of Test Day

- Eat good meals at regular times.
- Continue your sleep/wake-up schedule all week long.
- Practice in a test-like environment.
- Avoid doing anything new or unusual.

KAPLAN TIP
Even though thinking about Test Day can induce anxiety, remember to focus on success and your future as a physician!

The MCAT Lucky 7 (Round Two):

Rules for the Day Before the MCAT

Rule # 1: Avoid talking about the MCAT.

Rule # 2: Within reason, avoid studying for the MCAT.

Rule # 3: Plan your day; do something engaging that you enjoy.

Rule # 4: Envision your post-MCAT activities.

Rule # 5: Eat high-energy foods.

Rule # 6: Get enough sleep.

Rule # 7: Gather your Test Day materials.

Test Day Materials Checklist:

- Printout of your confirmation email
- Personal identification (two)
- Snacks/sports drink (if allowed)
- Lunch
- Magazines/newspaper
- Earplugs
- Tissues
- Cough drops
- Painkillers
- Antacid
- Pump-up music/good-luck token/lucky T-shirt
- Write your own list items here:

KAPLAN TIP

This day before the MCAT is important and can potentially have a big impact on Test Day. Therefore, plan it well and use it wisely to make sure the next day, Test Day, is the best that it can be.

KAPLAN TIP

Commonly prohibited items in the actual testing room are outerwear, hats, food, drinks, purses, briefcases, notebooks, pagers, watches, cellular telephones, recording devices, photographic equipment, and (of course) MCAT study materials.

What to do ...

... on Test Day

- Wake up on time.
- Eat your normal breakfast.
- Warm up physically and mentally.
- Wear comfortable clothing and dress in layers.
- Bring high-energy foods for snacks.
- Arrive at the test site with time to spare.
- Bring all your testing materials.

... during the MCAT

- Do the tutorial in order to get comfortable with the computer.
- Handle (the rare) test administration difficulties properly and calmly.
- Triage all passages and questions. (Remember to do the discrete questions first!)
- Answer every question.
- Reset your mind during breaks.
- Focus on what is in front of you.
- Don't discuss the test during breaks or after the exam.

Should I Void My Score?

No, not if you . . .

- felt the test was hard.
- felt like you strategically guessed too many questions.
- didn't finish *every* passage.

Yes, if (and only if!) you . . .

- left a large number of questions blank.
- got physically ill during the test.
- had extreme test administration problems.

What to Do After the Test

- Relax.
- Send Kaplan those scores when you get them!
- Continue preparing to apply to medical school.
- Secure letters of recommendation.
- Work on a personal statement.
- Keep Kaplan updated with your journey to and through medical school and your career as a physician.

KAPLAN TIP

Once you're done with the test, make sure you celebrate your hard work! In fact, looking forward to this celebration is a great way to keep yourself motivated while you are studying.

LESSON 8.5 REVIEW

What to Do Now:

- Fill in your calendar with study time and other activities.
- Stay in contact with Kaplan for questions and information.
- Focus on building stamina and endurance by completing practice tests.
- Congratulate yourself on how far you've come.
- Focus on success! Remember that you are doing all of this to become a physician!