# AAMC MCAT 2015 Sample Test Solutions

*Edited and produced by*
Judene Wright, M.S., M.A.Ed.
National Content Director, MCAT Program
The Princeton Review

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*Bethany Blackwell, M.S. (Organic Chemistry)*
*Bill Ewing, Ph.D. (General Chemistry)*
*Jon Fowler, M.A. (Physics)*
*Judene Wright, M.S., M.A.Ed. (Biochemistry)*

*Jennifer Wooddell*

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CHEMICAL AND PHYSICAL FOUNDATIONS OF BIOLOGICAL SYSTEMS SOLUTIONS

Passage I (Items 1-4)

1. B Compound 1 is described as a “transition state analog” and a “potent inhibitor of HIV protease”. Thus, it is most likely functioning as an antagonist (choice B is correct). An agonist is something that acts in a similar fashion to something else, since this is inhibiting HIV protease it acting as neither the substrate nor the enzyme (choice A is wrong). A placebo would have no effect at all (choice C is wrong) and a catalyst would increase reactions, not inhibit them (choice D is wrong).

2. C As shown below (starred carbon atoms), Compound 1 has five chiral centers.

Since the molecule is highly asymmetric, it is safe to apply the $2^n$ rule to determine the total number of stereoisomers. Since $2^5$ is 32, choice C is the correct answer.

3. B The biological formation of kidney stones (calcium oxalate, CaC$_2$O$_4$) is a function of the following solubility equilibrium:

$$\text{CaC}_2\text{O}_4(s) \rightleftharpoons \text{Ca}^{2+}(aq) + \text{C}_2\text{O}_4^{2-}(aq)$$

$K_{sp}$ for this reaction can be written as:

$$K_{sp} = [\text{Ca}^{2+}][\text{C}_2\text{O}_4^{2-}]$$

For this 2x2 style question, choices A and C can be eliminated because the concentrations are multiplied to find $K_{sp}$, not summed. When the theoretical concentration of ions in solution exceeds $K_{sp}$, precipitation of the solid can be expected. Therefore, choice B is correct. When the product of the concentrations of the two ions is less than the $K_{sp}$, the solution is not yet saturated (eliminating choice D).

4. D Figure 1 shows the bond being cleaved by HIV protease; on the left is an amino acid that includes a phenyl group (Ph). Since neither valine (Val) nor alanine (Ala) include a phenyl group, choices B and C can be eliminated. On the right of the cleavage point is an amino acid in a ring structure. The only amino acid that forms a ring with the backbone atoms is proline (Pro, choice A can be eliminated and choice D is correct).

Passage II (Items 5-9)

5. B This question relies on prior knowledge of the charge distribution in an axon, where the interior is negatively charged and the exterior is positively charged. Electric field lines move from positive to negative charges, as reflected by choice B.
6. A  If not drawing on biology knowledge, one can mostly deduce the answer to this question from the information provided in table 1. Conductivity of the axon membrane decreases from \( \sim 10^{-4} \) to \( \sim 10^{-7} \) 1/(mΩ⋅m) when the axon is myelinated (the passage erroneously lists this as “conductivity per unit length,” but the units are just those of conductivity). Since conductivity is the reciprocal of resistivity, decreased conductivity is the same as increased resistivity. Thus a myelinated sheath acts as an insulting material, which is choice A. Choices B and D can be eliminated because they are contradicted by the information in the table: axon radius is unchanged with the addition of the myelin sheath, and capacitance decreases, not increases.

7. B  The question asks which of the choices is the smallest. Choice A, proteins, can be immediately eliminated. Potassium ions (choice B) can be eliminated as K is one row below Na on the periodic table. Within the same row, a cation (like Na) will always have a smaller radius than an anion. Since a chloride ion is an anion, choice D can be eliminated (Na\(^+\) = 102 pm; Cl\(^-\) = 181pm).

8. B  The graph in figure 2 shows that the width of the action potential peak of the response of a nerve cell to stimulus is about 1 millisecond. The passage also tells us that a nerve cell pulse travels at 100 m/s. Thus the minimum distance between electrodes measuring the voltage change is given by the kinematic relation distance = rate × time = 1 ms × 100 m/s = 0.1 meters.

9. D  To calculate the current through an axon, use Ohm’s law, \( I = V/R \). Potential is needed, eliminating choice A. Table 1 provides resistance per unit length, which is not the same thing as resistivity (the AAMC solution to this question is erroneous in that respect), but using a combination of either resistance per unit length or resistivity (with units of resistance × length) and length can yield resistance \( R \). Though radius also has units of length, the product of conductivity and radius or the quotient of resistivity and radius does not give resistance along the direction of current flow of an axon, eliminating choices B and C.

Passage III (Items 10-13)

10. B  The value of pH is defined as \( -\log[H^+] \). The given value of \([H^+]\) is \( 1 \times 10^{-5} \) M.

\[
\text{pH} = -\log[H^+]
\]
\[
-\text{pH} = \log(10^{-5})
\]
\[
-\text{pH} = -5
\]
\[
\text{pH} = 5
\]

11. C  The two most important clues given in the passage are that upon complete dissolution of the unknown substance the pH drops to 5 and the solution weakly conducts electricity. These two clues combined indicate limited dissociation of ions (weakly conducting) and that the ions that do dissociate include H\(^+\) (pH falls below neutral, but only very slightly). This is indicative of a weak acid being dissolved in water. Addition of a base would result in a pH greater than 7 (eliminate choices A and B), and the addition of even a small amount of strong acid would be expected to drive the pH down below the very mildly acidic pH of 5 (eliminate choice D).

12. D  In this question, two separate determinations must be made. When NO\(_2\)(OH) is dissolved, the pH of the solution falls. This is indicative of an acidic compound. Indeed, when not written in the AO\(_m\)(OH)\(_n\) form that the passage uses, NO\(_2\)(OH) may be written as the more familiar HNO\(_3\) (nitric acid). This allows the elimination of choices B and C. The compound Ni(OH)\(_2\) is an example of the AO\(_m\)(OH)\(_n\) formula where A is a transition metal. The passage states explicitly that when A is an alkali or alkaline earth metal the compounds are basic; however, by extension of the electronegativity relationship (a compound is basic when A has a low electronegativity), it can be surmised that Ni(OH)\(_2\) is a base. As a transition metal, Ni has a relatively low electronegativity, and when taken in conjunction with the fact that the compound is found to dissolve in acidic solutions it can be assumed that the compound dissociates by breaking the Ni—OH bond. This makes D the correct answer.
13. C Since the unknown compound is a weak acid (dissociates only partially, causing a slight decrease in pH), the correct answer will be the one that might be true for weak acids. The passage states that compounds of the formula $\text{AO}_m(\text{OH})_n$, where A is an alkali or alkaline earth metal are bases. This eliminates choice A. Noble gases are, with very rare exception, chemically inert and do not form oxyacids such as those discussed here (eliminate choice D). Transition metals are slightly more electronegative than the members of groups 1 and 2; however, they are far less electronegative than true nonmetals. Taking into account the electronegativity relationship given in the passage (a compound is basic when A has a low electronegativity), the best answer between the remaining two choices is C, nonmetals.

Freestanding Questions (Items 14-17)

14. C The structure of squalene, shown below, is reminiscent of the polyannular system of all steroid hormones. In fact, bond formation along the dotted lines would yield such as structure.

![Squalene Structure](image)

The lack of carboxyl groups in the structure eliminates choice A (triacyl glycerols), and the lack of a phosphate group eliminates phospholipids (choice B). Prostaglandins tend to be poly-hydroxylated, and tend not to have as many fused rings (eliminate choice D).

15. D Calcium is an alkaline earth metal, so as a cation it carries a $+2$ charge. This means that calcium chloride will have the formula $\text{CaCl}_2$, and two moles of $\text{Cl}^-$ will be generated for each mole of $\text{CaCl}_2$ dissolved. Since the molarity of the solution (0.1 $M$) is given as the concentration of $\text{CaCl}_2$, doubling this value will give the concentration of $\text{Cl}^-$ (0.2 $M$).

16. D The deposition of silver metal represents a reduction of silver ions (gain of electrons). Therefore, the question is asking which of the answer choices is not a reducing sugar. Reducing sugars contain either aldehydes or hemiacetals (which become aldehydes during mutarotation). Of the four answer choices, only choice D contains no hemiacetal functionalities. In choices A-C there is a hemiacetal on the far right hand side of each compound, as depicted for cellobiose below, making them reducing sugars.
17. C In the chain Arg-Ala-Phe-Leu the only ionizable side group resides on Arg. At a pH of 7.8 the positive charge at the N-terminus and the negative charge at the C-terminus balance one another. Arginine is shown below.

The R-group is basic (pK_a = 12.48 for the protonated form), meaning that at pH 7.8 it will carry a +1 charge, as will the peptide.

Passage IV (Items 18-21)

18. D Between Compound 1 and Compound 2, compound 2 is more polar on account of its extra alcohol moiety (eliminate choice B). It will therefore interact less favorably with the nonpolar stationary phase than Compound 1, preferring the polar mobile phase, and eluting first. This means choice D is correct. Choice C may be eliminated as increasing the affinity of any substance for the stationary phase will result in increased retention time. Choice A is incorrect because increasing the polarity of the mobile phase will further accelerate the elution of more highly polar materials (like Compound 2).

19. B Binding affinity is inversely related to K_m; a high K_m indicates that the enzyme has a low affinity for its substrate, and a low K_m indicates that the enzyme has a high affinity for its substrate. The data in Table 1 show that the wild type enzyme and it’s two variants have the same K_m, indicating that there is no change in the binding affinity when the amino acids are substituted (choice B is correct). The fact that the compound is being eliminated does not give us any information about binding affinity (choice A is wrong). CYP2C9*2 substitutes cysteine for arginine at position 144, and CYP2C9*3 substitutes leucine for isoleucine at position 359. While it may be true that these substitutions do not change the binding pocket of the enzymes, the data that supports this fact is given by the K_m values in Table 1. Since the question specifically asks for supportive data, choice B is better than choice C. None of the amino acids involved in either the wild type or the variants is charged at physiological pH. The only amino acids charged at physiological pH are glutamate, aspartate, arginine, lysine, and sometimes histidine (choice D is wrong).

20. D A Lineweaver-Burk plot is a plot of 1/V vs. 1/[S]. V_max is given by the y-intercept, and K_m by the x-intercept. Since V_max is different for all three variants, the y-intercept will be different for all three variants.

21. B In the overall reaction, NADPH is being oxidized, thus it is providing the reducing power and is the reducing agent (choice B is correct and choice A is wrong). It is not the enzyme, so is not a catalyst (choice C is wrong), and it is not an electrophile (choice D is wrong).

Passage V (Items 22-25)

22. A Equation 1 in the passage can be written as follows, including the oxidation states of the constitutive atoms:

\[ 2H^+ + Cl^- + Mg^{0} \rightarrow Mg^{2+}Cl^- + H^0 \]

From this description, it can be seen that Mg is oxidized (0 to +2) while H is reduced (+1 to 0). This means that the reaction is an oxidation/reduction reaction, and choice A is correct. A Lewis acid/Lewis base reaction is one in which an electron pair on one reactant (the base) is donated to the other (the acid) in the formation of a new compound (e.g., Cl^- + BCl3 \rightarrow BCl4^-). In these reactions the charge state of the atoms do not change (eliminate choice B). Double replacement, often called ion exchange, reactions are transformations in which ionic compounds simply switch anions and cations (e.g., CsCl + NaI \rightarrow CsI + NaCl). Again, in these reactions no oxidation occurs (eliminate choice C).
state changes occur (eliminate choice C). An ionization reaction generally describes the
dissociation of a neutral compound into its constitutive ions (e.g., HCl → H⁺ + Cl⁻), but the
oxidation states of the atoms in the compounds remain unchanged before and after the reaction
(eliminate choice D).

23. A Pascal’s Law states that points of equal height within a continuous fluid have equal pressures.
This means that the pressure at the level of the water in the beaker is \( P_{\text{atm}} \) both inside and
outside the buret. Inside the buret, this pressure is due both to the enclosed gas and to the
column of water, so the gas pressure alone in the buret must be less than \( P_{\text{atm}} \).

24. D The key to this question is the ability to recall the form of the Ideal Gas Law, \( PV=nRT \). If the goal
is to solve for the gas constant \( R \), then a bit of algebra including dividing both sides by \( (nT) \) will
yield \( R = \frac{PV}{nT} \). The experiment described in the passage should provide values for each of
these variables. Choices A and C are algebraic forms of the Ideal Gas Law that are not properly
solved for \( R \). Choice B is an incorrect relationship between the variables, derived from an
incorrect gas law.

25. C From the first sentence of the second paragraph of the passage,

“The ideal gas constant \( R \) can be found by measuring the volume that a
given amount of gas occupies at a certain temperature and pressure.”

it may be surmised that the goal of the experiment is useful for determining \( R \), and all the data
necessary to do so can be obtained through the experiment. The volume of the collected gas is
read from the buret. The pressure can be obtained from the known mass of water in the buret.
The moles of \( \text{H}_2 \) produced are known from the initial mass of Mg used, and the reaction is
equilibrated at room temperature. Choice A can be eliminated as molecules in an ideal gas are
treated as massless particles. Choice B may be eliminated as the determination of reaction
mechanisms generally require kinetic measurements, which are not taken here. Choice D may be
eliminated as a study of the reaction of Mg with acids (plural) would likely involve the use of more
than one acid, or a stoichiometric reaction (the acid is added in excess to completely dissolve the
metal).

Freestanding Questions (Items 26-29)
26. C This is a dimensional analysis question. The given data is that the human body contains about 5
L of blood, and that the density of blood is about 1060 kg/m³. Also given is that 1 L = 1000 cm³.
From this we can say that 5 L = 5000 cm³.

\[
1 \text{m}^3 = 1 \text{ m} \times 1 \text{ m} \times 1 \text{ m} = 100 \text{ cm} \times 100 \text{ cm} \times 100 \text{ cm} = 10^8 \text{ cm}^3
\]

Therefore, the density of blood is \( (1060 \times 10^{-6}) \text{ kg/cm}^3 \). Then,

\[
5000 \text{ cm}^3 \times (1060 \times 10^{-6}) \text{ kg/cm}^3 = 5000 \text{ cm}^3 \times (0.001) \text{ kg/cm}^3
\]

\[= \sim 5 \text{ kg} \]

The best answer is choice C.

27 B One way to think about this question is to consider what can be directly measured versus what
the ultrasound probe is designed to discover indirectly. The purpose of the probe is to see motion
in the fetus, so knowing the speed of the moving object beforehand is unrealistic: that’s what it is
trying to find! This eliminates choices A, C, and D. Choice B is correct because the Doppler shift
relates frequencies at the source and the detector (which was the original source prior to
frequency shifting upon reflection off of the fetus), the speed of sound, and speeds of the source
and detector (in this case, the same object, again due to reflection). Knowing the first three of these determines the fourth.

28. C As in any boiling point trend, the reason that HF has an anomalously high boiling point is a function of intermolecular forces. One commonly employed definition of hydrogen bonding is interactions between an H bound to an F, O or N, with a lone pair of electrons on another F, O or N. This is a way of denoting a very strong dipole interaction. Since HF can participate in intermolecular hydrogen bonding, while HCl, HBr, and HI cannot, it experiences greater intermolecular forces, requiring more energy to escape from a condensed phase. Choice A is an incorrect statement, as the polarity of HF is greater than in the other hydrogen halides. Choice B is a correct statement, but does not explain the phenomenon, as normally compounds with lower molecular weights have lower boiling points than comparatively heavy compounds. Choice D is an incorrect statement, as HF has a lower vapor pressure (is less volatile, has a higher boiling point) than the other hydrogen halides.

29. A The principle quantum number \( n \) is the primary factor in determining the radial size of the orbitals in question. In an electron configuration, \( n \) is the number put in front of the orbital (e.g., \( n \) is 3 for \( 3s^2 \), and 2 in \( 2p^6 \)). This number increases as one goes down the periodic table. Choice B can be eliminated as it is the azimuthal quantum number \( l \), which determines the shape of an orbital (\( s, p, d \), etc.). Choice C can be eliminated, as each electron has its own quantum number, not just the valence electrons as the choice suggests. Choice D can be eliminated as the sum of the protons and neutrons in the nucleus comprise the atomic mass of the atom, and have nothing to do with electronic quantum numbers.

Passage VI (Items 30-33)

30. B Table 2 gives the relevant data for the binding of CPFX to BSA in the presence of various metal ions. The legend states that \( K_0 \) is the binding constant of CPFX-BSA in the absence of metal ions. Since the \( K_a/K_0 \) ratio is less than 1.0 in all cases, the presence of metal ions decreases the binding of CPFX to BSA (choice B is correct and choices A and D are wrong). Note that a \( K_a/K_0 \) ratio of 1.0 would occur if binding to BSA was the same in the presence or absence of metal ions, and it would be greater than 1.0 if binding to BSA was increased in the presence of metal ions. If less CPFS is binding to BSA, then the amount of free CPFX in plasma should increase (choice C is wrong).

31. D The structure of ibuprofen is given in Figure 1, and shows a hydrocarbon backbone with a carboxylic acid functional group. Of the four molecules given, only palmitoleic acid, a fatty acid, has a hydrocarbon backbone and a carboxylic acid functional group (choice D is correct).

32. C The data in Table 1 shows that the \( K_a/K_0 \) ratio for CPFX-BSA binding in the presence of warfarin is significantly lower than the \( K_a/K_0 \) ratio for CPFX-BSA binding in the presence of ibuprofen. In other words, the presence of warfarin (which binds to Site I) disrupts the binding of CPFX to BSA more than does the presence of ibuprofen (which binds to Site II), thus CPFX must be binding to Site I (choice C is correct and choices A, B, and D are wrong).

33. A The passage states that the ligands for the binding sites tend to be “hydrophobic with anionic features”, thus amino acids in Sites I and II are likely to be hydrophobic and carry positive charges (hydrophobic amino acids will interact favorably with hydrophobic ligands, and positively-charged amino acids will interact favorably with negatively-charged, anionic ligands). R (arginine) is positively charged and L (leucine) is hydrophobic (choice A is correct). E (glutamic acid) and D (aspartic acid) are typically negatively charged (choices B, C, and D are wrong). Note that Y (tyrosine) is hydrophilic and H (histidine) is sometimes charged and sometimes not.
Passage VII (Items 34-37)

34. D This is a straightforward application of the formula relating density, mass, and volume: \( \rho = \frac{M}{V} = 4 \times 10^{-3} \text{ kg} / 5 \times 10^{-7} \text{ m}^3 = 8 \times 10^3 \text{ kg/m}^3 \).

35. A This question requires extracting the data points in Table 1 that correspond to the graph, namely temperature and resistance. It is immediately clear that, as \( T \) increases, so does \( R \), eliminating choices B and D. To determine that choice A is correct, note that the interval between successive trials after 2 is always both \( \Delta T = 100 \text{ °C} \) and \( \Delta R = 2.6 \Omega \). Therefore the plot should form a straight line. This eliminates choice C.

36. A The increase of temperature with the absorption of heat (in the absence of a phase change) is determined by the formula \( q = mc(\Delta T) \) where \( q \) is the heat transferred, \( m \) is the mass, and \( c \) is the specific heat of the substance in question (in this case 460 J/kg·K). The mass of the wire is 4 \( \times 10^{-3} \) kg, and \( \Delta T = 200 \text{ K} \).

\[
q = (4 \times 10^{-3} \text{ kg})(460 \text{ J/kg·K})(200 \text{ K})
\]

Even without solving the equation, it is clear that choice A is the only answer possible, as it is the only answer less than 460.

37. D Unfortunately, the correct answer to this question is not among the choices, and the AAMC’s posted solution is incorrect because resistivity is not directly proportional to temperature (there is a range over which resistivity versus temperature is linear, but it is only true for part of the graph, and the line does not intercept the origin as a true linear proportion must). However, the best choice is still the correct one. Note in Table 1 that the current in trial 6 is 2 A at 28 V, eliminating choices B and C. The table also shows resistance increases with temperature, from 4 \( \Omega \) at 293 K to 13.9 \( \Omega \) at 673 K. Therefore at constant voltage, the current should decrease from some higher value to the final value of 2 A. (According to the given values, the current should decrease from 28 V / 4 \( \Omega \) = 7 A down to the final value of 2 A.)

Passage VIII (Items 38-42)

38. D In the described reaction, one must follow the reaction sequence to determine the placement of the \(^{14}\text{C} \) atoms. In the top reaction shown below, mevalonate is constructed from labeled hydroxymethylglutarylCoA. Construction from labeled acetyl-CoA means at that each non-heteroatom-bound carbon will be a \(^{14}\text{C} \) nucleus. As shown in the bottom equation, taking the phosphonated mevalonate through the reaction depicted in the question will leave labeled carbons at the 5, 4, and 2 positions (numbering scheme in the question).
39. **A** Ring closing reactions, especially those forming the thermodynamically favored six-membered rings, are very common. Below is a depiction of the reaction that may be expected to occur with mevalonic acid.

![Reaction Diagram]

Choices C and D depict thermodynamically unfavorable reactions. Peroxides (choice C) and four-membered rings (choice D) are both very high energy species, and unlikely to form from a stable molecule such as mevalonic acid. Choice B depicts a reduction reaction, which does not occur.

40. **B** Mevalonate contains hydroxyls (~3300 cm$^{-1}$) and a carbonyl group (~1700 cm$^{-1}$) but no C=C double bond, which would give a stretch in the 1580-1610 cm$^{-1}$ region. Therefore, items I and II are true, but not III, meaning choice B is correct.

41. **D** In reaction 2, none of the reactants are chiral, which eliminates choices A and B. As this is a biosynthetic pathway the solvent medium is water, and achiral (eliminate choice C). This leaves a chiral enzyme as the source of chirality for the product. Enzymes are routinely chiral, built to be able to synthesize chiral compounds.

42. **A** Squalene is a terpene (a lipid) and is a precursor to cholesterol (choice C is a product of squalene metabolism and can be eliminated) and steroid hormones (choices B and D are products of squalene metabolism and can be eliminated). Glucose is structurally very different from squalene (choice A is not a product of squalene metabolism and is the correct answer choice).

**Freestanding Questions (Items 43-46)**

43. **C** Myopia is treated with diverging lenses, because the power of the eye’s cornea and lens system is too high, so a negative power lens is required to lower it appropriately. Put another way, the myopic eye focuses light from distant objects prior to its reaching the retina, and the addition of a diverging lens moves the focal point further back to reach the retina. Choices A and D can be eliminated as irrelevant to this particular vision abnormality (a cylindrical lens is used to correct astigmatism, and a spherical lens is just the normal lens shape).

44. **A** The goal of most polypeptide and protein extraction methods is to keep the protein from denaturing. Sublimation, the phase change of water from solid to gaseous state, eliminates the water from the sample without raising the temperature and possibly denaturing the protein (choice A is correct). Steam distillation would increase the temp and damage the protein (choice B is wrong), and addition of organic solvents or magnesium sulfate could also denature the protein (choices C and D are wrong).
45. A Sulfuric acid will hydrolyze the acetal functionalities in any of the given answer choices. The sequence below depicts how choice A is the correct answer.

The benzaldehyde fragment could not be a product of the hydrolysis of the compounds in choices B, C, and D. Likewise, cyanohydrin hydrolysis using a CN will not leave behind the hydroxyl necessary for the structure of free glucose.

46. A The best approach to this question is Process of Elimination. The question asks for an expression to which the density of an object (in this case a person) is proportional. This means in principle that the algebraic expression should have an isolated term for the density of the object in the numerator, as in (something) $\times \rho_o$. Since the weight in air is approximately $W_{\text{air}} = \rho_o V g$ (neglecting minimal buoyancy due to the atmosphere), only choice A fits this requirement. Choices B and C have the wrong density in the numerator and can be eliminated, because $W_{\text{air}} - W_{\text{W}} = \rho_o V g - (\rho_o V g - \rho_v V g) = \rho_v V g$. Choice D is eliminated because it has two terms in the numerator.

Passage IX (Items 47-51)

47. C The only pH active group at neutral pH on pantothenate is the carboxylic acid, which has a $pK_a$ around 3, and will be deprotonated giving a charge of $-1$. Phosphopantothenate has both the carboxylic acid as well as a di-protonated phosphate group, which will lose both protons to give an overall charge of $-3$. There may be some question as to whether the phosphate will lose both protons ($pK_{a2}$ of phosphoric acid is $\sim 7.2$); however, since $-2$ is not a charge state in any answer choice for phosphopantothenate, choice C is the best answer, since the first $H^+$ will definitely be dissociated ($pK_{a1} = \sim 2.1$).

48. D Figure 1 shows the structure of Coenzyme A. It contains a nucleotide with a hydroxyl group on the 2’ carbon, so it is not a deoxynucleotide (choices A and C can be eliminated). The additional phosphate is on the 3’ carbon (choice B can be eliminated and choice D is correct).

49. C The passage states that the stabilization of pantothenate is due to interactions between the hydroxyl groups of pantothenate and a carboxylate group of PanK3. Of the amino acids listed, only aspartate has a carboxylate group (choice C is correct and choices A, B, and D are wrong).

50. B The passage states that the binding of ADP involves predominantly ionic interactions, and since ADP is negatively charged (due to its phosphate groups), the best amino acids for stabilization would carry a positive charge. Of the amino acids listed, arginine (Arg) is positively charged, and histidine (His) is sometimes positively charged (choice B is correct). Aspartic acid (Asp) is negatively charged, so would not help stabilize the negative charges on ADP (choices C and D can be eliminated), and while asparagine (Asn) and threonine (Thr) are both polar, they are uncharged (choice B is better than choice A).

51. A An oxidation is a loss of electrons or hydrogen (choice B is wrong) and a reduction is the gain of electrons or hydrogen (choice C is wrong). The passage states that pyruvate is converted to lactate with simultaneous use of NADH, and that the “consumption of NADH was measured”. This indicates that NADH is being used up, not produced (choice A is correct and choice D is wrong).
Passage X (Items 52-56)

52. B This is a straightforward computational problem using the equation for the energy of a photon, $E = hf$, leading to $f = E / h = (140 \text{ keV}) / (4.14 \times 10^{-15} \text{ eV-s}) = (14/4) \times 10^4/10^{-15} = 3.5 \times 10^{19} \text{ Hz}$. Knowledge of the EM spectrum of frequencies allows the immediate elimination of choices C and D for having far too low frequencies, whereas choice A is extremely (if not impossibly) high.

53. A This question requires interpreting figure 2 to determine the half life, that is, the time it takes the sample to decay to half its original radioactivity. The initial value of the radioactivity of the sample is about 500 MBq, and it appears that the radioactivity drops to 250 MBq after about 5 hours. Choice A is the closest value to this.

54. B This is a simple definition question. The passage states that the decay of $^{99}$Mo releases a $\beta^-$ particle, which is simply the name for an electron emitted in a nuclear decay process.

55. B This question is best approached using Process of Elimination. Detection of sonic Doppler shift is useful for determining relative motion of the source and detector of a sound wave, because such motion causes a shift in the frequency between that emitted by the source and that received by the detector. Thus it would not be helpful in determining the density of a substance (eliminating choices A and C) or the thickness of a stationary material (eliminating choice D). Blood flow can involve motion of blood toward or away from the detector, which would be measured as a Doppler shift in the emitted frequency.

56. B This is a straightforward computational problem using values given in the passage and the question stem along with the equation relating work and power, $P = W / t$, which yields $W = Pt = (30 \text{ W})(3 \text{ min} \times 60 \text{ s/min}) = 5400 \text{ J}$.

Freestanding Questions (Items 57-59)

57. B When choosing a buffer, it is important to select one that has a $pK_a$ as close to the desired buffering pH as possible. This allows the buffer to be equally effective in counteracting both changes in the acidic and basic directions. Since the pH of interest in the question is 5.3, the closest $pK_a$ is 4.75 (choice B).

58. D The relationship between specific heat, temperature change and absorbed heat is given by $q = mc(\Delta T)$. In this case $m = 0.1 \text{ kg}$, $\Delta T = 5^\circ \text{C}$ and $q = 250 \text{ J}$.

\[
q/(m\Delta T) = c \\
250 \text{ J}/(0.1 \text{ kg} \times 5^\circ \text{C}) = (2500/5) \text{ J/kg\cdot}^\circ \text{C} \\
= 500 \text{ J/kg\cdot}^\circ \text{C}
\]

59. D The question asks for a balanced reaction. Choices B and C do not have balanced hydrogen and can be eliminated. To choose between A and D, use oxidation/reduction half-reactions and add them together. The half-reaction for the reduction of pyruvate is $\text{CH}_3\text{COCO}_2^- + 2\text{H}^+ + 2e^- \rightarrow \text{CH}_3\text{CH(OH)CO}_2^-$. The half reaction for the oxidation of NADH is $\text{NADH} \rightarrow \text{NAD}^+ + \text{H}^+ + 2e^-$. Adding these together, the electrons cancel out, and one of the $\text{H}^+$ on the reactant side cancels the $\text{H}^+$ on the product side (choice D is correct and choice A is wrong). Another way to tackle this is to remember that during fermentation, 2 pyruvate are reduced to 2 lactate, while 2 NADH are oxidized to 2 NAD$^+$. Thus each pyruvate requires 1 NADH, and choice A, which shows pyruvate + 2 NADH, cannot be correct.
Passage I (Items 1-7)

Passage Text

P1: Apparent increase in heart disease after WWII seen as epidemic.
P2: One theory was cholesterol, but no conclusive proof.
P3: Despite lack of proof, Select Committee made dietary recommendations.
P4: Experts criticized dietary guidelines as unfounded.
P5: Latest dietary thought: carbohydrates as cause.
P6: Supporters of dietary guidelines make political arguments, but critics focus on lack of evidence and risk of harm.
P7: Government should leave it to individuals.

Bottom Line: There is no proof that diet causes heart disease, and government dietary recommendations may do harm.

Questions

1. A This is an Inference question.
   A: Yes. The author states in the first paragraph that “Some observers cautioned that the apparent increase [in heart disease] might be the result of diagnostic advances, which had improved doctors' ability to detect heart ailments.” That is, there was no actual increase in the occurrence of heart disease; it was just that a higher percentage of those who had heart disease were being correctly diagnosed.
   B: No. The author implies the opposite. The passage states that these observers believed that diagnostic advances were accurately (not mistakenly) identifying heart disease, and that this may have been the real reason why heart disease appeared to be increasing.
   C: No. This choice is out of scope. The passage does not suggest that overall death rates were increasing after WWII. The issue is the apparent increase in the death rate specifically due to heart disease, and whether or not that the disease was in fact occurring more frequently.
   D: No. This choice makes a connection that is not made in the passage, and misses the issue raised in the question. Even though there was in fact a decline in deaths due to communicable diseases, the observers did not suggest a causal link between an increase in heart disease and the decline in communicable diseases. In fact, they questioned whether there was in fact a true increase in the incidence of heart disease.

2. D This is an Inference question.
   Note: This question is essentially asking for at least part of the author’s criticism of the dietary hypothesis. That is, it will suggest a reason why that hypothesis is questionable.
   A: No. The author does not suggest reverse causality; that is, that heart disease caused a change in diet.
   B: No. An argument that mistakes correlation for causation would say something like the following: “Because a high percentage of people with heart disease eat a high-cholesterol diet, those people’s diets are the cause of their heart disease.” However, the passage never describes any such correlation. The supposed evidence for the dietary explanation consists of hypotheses based on the effects of cholesterol on the body (paragraphs 2 and 5).
   C: No. The author never does suggest a possible alternate "common cause" for heart disease that should have been considered.
   D: Yes. In paragraph 2 the author writes: “In addition to diet, multiple factors were potential contributors [to heart disease], including genetics and personal habits such as smoking.” This is part of the author's criticism of the dietary explanation: it does not consider possible alternate causes.
3. D This is an Inference/Roman numeral question.  
Note: The wording of this question may sound a bit odd; you are looking for factors or concepts that are important aspects of Ahrens’ criticism of the dietary recommendations (paragraph 4).

Item I: True. Ahrens “characterized the guidelines as simplistic….” Therefore, you can conclude Ahrens believed that the potential complexity (the opposite of simplicity) of the causes of heart disease needs to be considered.

Item II: False. “Flexibility” is out of scope; nothing in Ahrens’ criticism indicates that he believes that the recommendations should have been more accommodating. Note that although you might think that “diversity” is similar to “flexibility,” in the context of the passage diversity alludes to complexity, which is not the same thing as being looser or more adaptable.

Item III: True. “Ahrens complained that the guidelines treated the population ‘a homogeneous group of [laboratory] rats while ignoring the wide variation' in individual diet and blood chemistry.” Therefore, you can infer that Ahrens thought it was important to take the diversity of the population into account.

4. A This is a Structure question.
A: Yes. To see that this is the purpose of the cited reference from paragraph 5, you have take paragraph 3 into account, where the author states that the 1977 guidelines recommended raising carbohydrate intake. Since the latest thinking suggests that eating simple carbohydrates may be a cause of heart disease, you can reasonably conclude that the author is indicating a potential threat posed by the earlier (1977) recommendations.

B: No. This is the right answer to the wrong question. The question asks why the author mentions “easily digestible carbohydrates.” While it may be true, based on passage information, that nutritional thinking changes over time, this is not the purpose of the cited statement in the context of the passage. Note that change over time is not an important theme in the passage, while the questionable nature of the 1977 recommendations is.

C: No. Be careful not to use outside knowledge or personal opinion. While you may believe this to be true, no “obesity crisis’ is mentioned in the passage.

D: No. This choice is out of scope and has the wrong tone. The author neither describes nor criticizes how most Americans eat. As with choice C, be careful not to use outside knowledge or opinion.

5. B This is a Strengthen question.  
Note: The author’s conclusion is stated in the last paragraph: “The best thing that the U.S. government can do to promote health is to encourage people to develop their own individually-tailored diet and exercise programs….” The correct answer will be the one that gives the strongest evidence that individuals are able to do this largely on their own.

A: No. This answer is tempting since food labels would provide information to individuals. However, it doesn’t go far enough to strengthen the author’s conclusion; it gives no real evidence that individuals can or would effectively use that information to promote their own health.

B: Yes. This choice indicates that when parents took responsibility for nutrition, one aspect of health (obesity) was better than it is now. This provides direct evidence that people can effectively manage their own diet to promote their own health.

C: No. This would, if anything, undermine the author’s argument rather than support it. The author has a negative opinion of government involvement in nutrition policy. If most public health officials have a positive opinion, this would be inconsistent with the author’s conclusion.

D: No. This choice does the opposite of what the question requires; that is, it weakens rather than strengthens the author’s argument. It suggests that government intervention can have a very positive effect, while the author argues that the government should limit its involvement.
6. **C** This is an Analogy question

*Note: In the sixth paragraph the author states that “the major scientific dissenters from government dietary policy...dissent because they find the government’s evidence inadequate and its recommendations potentially harmful.” Therefore you are looking for an answer that represents a criticism based on the potential for an actual physical risk or harm (as opposed to political considerations).*

A: No. This would be more of a political consideration; there is no suggestion of any potential for physical harm.
B: No. This is explicitly described as a political issue rather than as a criticism based on the potential for physical risk or harm.
C: Yes. A design flaw in the shuttle could definitely present a threat to the physical well-being of those on the shuttle. While you don't know that the shuttle would in fact fail based on those flaws (or even that there would be a shuttle crew), this is the only choice that presents the possibility of a threat to physical well-being.
D: No. This choice is out of scope. The “dissenters” do not raise financial considerations.

7. **A** This is an Inference question.

A: Yes. In the final paragraph, the author opposes government intervention in nutritional policy. Therefore, you can infer that the author would oppose government intervention in other areas, such as legislation imposing a limit on work hours and taking that decision away from individuals.
B: No. This choice represents less government involvement, which is consistent with the author’s argument against government intervention in nutrition (paragraph 7). Therefore, there is no basis on which to conclude that the author would oppose this.
C: No. The last paragraph indicates that the author has a negative attitude towards government intervention. Therefore, there is no reason to believe that the author would oppose loosening regulations on lobbying (which would represent less government interference). Note that while lobbying is mentioned in paragraph 6, the author does not indicate that he or she has a negative opinion of lobbyists (even though other people mentioned in that paragraph might), or that he or she believes that lobbyist should be regulated.
D: No. This choice is entirely consistent with the author’s opinion that the government should not significantly intervene in nutrition policy. Thus, there is no reason to think that the author would oppose a decrease in government oversight of school lunches.

**Passage II (Items 8-12)**

*Passage Text*

P1: Dali’s behavior led people to focus more on his personality than his art – caused misunderstandings.
P2: Yet, actually serious about painting.
P3: However, his behavior closely connected to his artistic achievement.
P4: Transformed Surrealist principles into way of living.
P5: While Surrealists eventually rejected him, he was important part of art history.
Bottom Line: Dali’s extreme behavior allowed him to live out artistic principles in an admirable and important way.

*Questions*

8. **D** This is an Inference/Structure question.

*Note: The correct answer will be the statement that is most supported by evidence explicitly provided in the text.*

A: No. The author indicates the opposite in the final paragraph: “His fantastic imagination, which was so fertile in its dazzling inventions, ended by worrying the Surrealist group; it overstepped the
mark and even invited the public to make fun of the movement’s convictions.” The Surrealists eventually rejected Dali because he was more scandalous than they were.

B: No. This choice is half right but half wrong; it introduces a contrast that is not supported by the passage. While the last paragraph suggests that Dali will be long remembered, the passage does not indicate that other artists will be forgotten.

C: No. While there seems to be some support for this claim in paragraph 2, it is not strongly supported by evidence provided by the author. The passage states that there is “fairly convincing proof that this frivolous and exuberant impresario was capable of the strictest asceticism while he was painting a picture,” but that proof is never described. Furthermore, “asceticism” (severity or plainness) is not necessarily the same thing as “total focus.” Compare this to choice D, which is more directly supported by explicit evidence provided in the passage.

D: Yes. In paragraph 3 the author states that Dali’s strange behavior “satisfied a need to keep his mind in a state of excitement that would be congenial to his artistic activity.” Furthermore, his public actions “were useful, too, in winning immediate acceptance for his most fantastic works... .” The statement in this answer choice, therefore, is strongly supported by evidence explicitly provided in the passage.

9. B This is an Inference question.

Note: The correct answer will be the one that most closely corresponds to the author’s description of Surrealism and of Dali’s work. In paragraph 1 the author describes Dali’s unexpected juxtapositions, such as lecturing in a diving suit or driving a car filled with cauliflower. In paragraph 4, the author states that Dali followed the principles of Surrealism in part by “cultivating his hallucinations,” creating a “delirium of organized interpretations,” and expressing his “fantastic imagination.”

A: No. There is nothing unexpected or hallucinatory about an indistinct painting of flowers; the fact that it only becomes clear at a distance is not particularly delirious or unusual.

B: Yes. This painting puts two things together (a telephone and a lobster) in the same way that Dali combined things in an unexpected and “hallucinatory” way.

C: No. There is nothing particularly fantastic or hallucinatory about a sculpture with spinning shapes.

D: No. As with choices A and C, there is nothing strange, unexpected, delirious, or “hallucinatory” about a work of art consisting of photos of celebrities.

10. C This is an Attitude question.

A: No. This choice contradicts the passage. In paragraph 4 the author quotes Dali as saying “The Only difference between a madman and me is that I am not mad.”

B: No. This choice contradicts the passage. In the final paragraph the author states that Dali, according to the Surrealists, took things too far. His behavior worried them, and they eventually rejected him. Thus you can infer that most Surrealists did NOT indulge in similar behavior.

C: Yes. In paragraph 3 the author expresses a positive attitude towards Dali’s actions and the purposes behind them, saying: “His provocative attitudes were not adopted for publicity purpose only [indicating that they were in fact adopted in part for publicity], but satisfied a need to keep his mind in a state of excitement that would be congenial to his artistic activity [that is, artistic reasons]. The word “necessary” may sound a bit extreme, but the author’s argument that Dali’s behavior was an integral part of his artistic production gives it reasonable support, especially given that the other three choices contradict the passage.

D: No. This choice contradicts the passage. In paragraph 2 the author calls Dali “an admirable creator” and “a man possessed by painting.” The author believes that Dali’s behavior was part of his artistry, not a diversionary tactic to hide some lack of skill.
11. **D** This is a New Information question.
   **A:** No. First, while the author suggests that Dali may have behaved as he did in part to gain recognition (paragraph 3), the author does not suggest that Dali joined the Surrealists for that reason (rather, it seems to have been because of agreement with their principles according to paragraph 4). Second, the question asks for Hitchcock’s motivation in seeking Dali’s help; there is no reason to conclude that Dali’s attention-seeking would have drawn Hitchcock to him.
   **B:** No. While there is some support for this statement in the passage (paragraphs 1 and 3), there is no reason, based on the passage or the information in the question stem, to conclude that public appreciation for Dali’s madness would have motivated Hitchcock to work with him.
   **C:** No. This is the right answer to the wrong question. While the author indicates this to be true (for example, in paragraph 2), Dali’s dedication as an artist would not explain why Hitchcock sought him out for this particular film.
   **D:** Yes. Note that Dali created “a dream sequence” and that the film was a “psychological thriller.” And, paragraph 4 states that Dali “transformed [Surrealism’s] interests in the revelations of the unconscious and psychopathological states into a way of thinking and living.” It is reasonable to conclude that Hitchcock would be drawn to Dali’s work because of the psychological and hallucinatory aspects of Dali’s life and work. Note that this is the only choice that has a thematic connection to the new information in the question.

12. **A** This is an Inference question.
   **A:** Yes. In paragraph 3 the author writes that Dali, a painter, “seized on the guiding principles of Surrealism and gave them their most extreme interpretation; he transformed its interest in the revelations of the unconscious...into a way of living and thinking.” From this Dali created a system that “consisted of cultivating his hallucinations...” From this it would be reasonable to assume 1) that Surrealism also dealt with hallucinations and dream-like images and 2) that at least some other Surrealists were also painters (on canvas). Note also that the other three choices are either far out of scope or contradict the passage.
   **B:** No. The passage suggests the opposite. See the final paragraph. Given that the Surrealists were concerned by Dali’s wacky behavior in public (behavior that perhaps could be described as childlike), you cannot assume that Surrealism would encourage artists in general to act in this way.
   **C:** No. The passage suggests the opposite. Paragraph 3 mentions the Surrealist’s “interest in the revelations of the unconscious and psychopathological states.” Dali followed and extended these ideas by “cultivating his hallucinations and putting himself into a state of feigned madness... .” This does not sound like “reflecting the world as clearly as possible.”
   **D:** No. This choice is out of scope. The passage never mentions stress or stress relief.

**Passage III (Items 13-19)**

**Passage Text**

P1: Discovery of projectile points along with human bones showed that PaleoIndians were hunters.
P2: New discovery provided even more such evidence.
P3: Hunters gathered material themselves.
P4: The geography of the time attracted game to these sites.
P5: Tools had many uses.
P6: Have to dig quickly before artifacts erode.

**Bottom Line:** Artifacts provide evidence about life of Paleoindians.

**Questions**

13. **B** This is a Retrieval question.
   **A:** No. The passage states the opposite in paragraph 2. “[W]ind erosion is continuously exposing new artifacts” which has “enabled archeologists to study a wind variety of pointed and other tools... .”
B: Yes. This is directly stated in the last paragraph: “Digging and collecting at the San Luis site have proceeded with some urgency, since wind erosion is exposing and damaging many artifacts.”

C: No. The author never suggests that few bison bones have been found. If anything, the passage suggests that a fair number have been uncovered.

D: No. The problem, according to the last paragraph, is wind; current levels of rainfall are never mentioned.

14. D This is a Retrieval question.
A: No. This choice is out of scope. Cultivation of crops is never mentioned.
B: No. This choice is too extreme. While the passage states that the grassy sand dunes “attracted bison and other game animals” (paragraph 4), the author does not indicate how many different types of animals the Paleoindians hunted and ate.
C: No. The passage suggests the opposite: “There was apparently little trading and no long-distance movement between the geographically separated bands of Paleoindians” (paragraph 3).
D: Yes. This is stated in paragraph 3: “…each small population of hunters made tools out of material they gathered themselves.” (If the material was gathered by the people themselves, it must have been “nearby.”) The fact that some of the tools were made from rocks is given in paragraphs 1 and 3; for example, in paragraph 3 the author discusses the location of “Some of the rock sources for the tools…”

15. B This is an Inference question.
A: No. This choice is out of scope; migration of animals is not discussed. All you know is that they were attracted to grassy dunes and waterholes; you don’t know that they were attracted from far away. Even if this choice was true based on the passage, it would not be supported by the coexistence of human bones, tools and animal bones in a single site.
B: Yes. In paragraph 5 the author states that “clusters of tools and bones” were found at the San Luis site, which also included human remains. This suggests “the remains of a hearth around which domestic activities took place.”
C: No. The passage indicates the opposite. Clusters of human and animal remains and tools were found at the San Luis site, and the last paragraph states that this site is experiencing significant erosion.
D: No. The passage states the opposite in paragraph 3: “There was apparently little trading and no long-distance movement between the geographically separated bands of Paleoindians.”

16. D This is a New Information/EXCEPT question.
Note: The passage states that tools and animal and human bones have been found in at least two Folsom sites. You can reasonably infer that this new Folsom site would contain similar objects. The correct answer will contain objects that one would NOT expect to find at a Folsom site, given what we already know from the passage.
A: No. Tools and bones were found in at least two existing Folsom sites (paragraphs 1 and 2).
B: No. The passage suggests that human bones were found at a variety of Folsom sites (paragraph 1).
C: No. Remains of a hearth were uncovered at the San Luis Folsom site. Therefore, if would not be surprising to find the same at this new Folsom site in Texas.
D: Yes. In paragraph 3 the author states: “An important conclusion from investigations at [the San Luis] site, as well as from comparison with other Folsom hunter sites, is that each small population of hunters made tools out of material they gathered themselves. There was apparently little trading and no long-distance movement between the geographically separated bands of Paleoindians.” The new site mentioned in the question stem is in Texas. Therefore, you would NOT expect to find tools made of flint from elsewhere (Colorado).
17. A  This is a Structure question.
   Note: The correct answer must be 1) stated in the passage and 2) stated in support for the claim that
   bands of Paleoindians did not trade with each other.

   A: Yes. The question stem references a claim explicitly made in paragraph 3, and asks what
evidence is provided by the passage for this claim. The paragraph begins: “An important
conclusion from investigations at [the San Luis] site, as well as from comparison with
other Folsom hunter sites, is that each small population of hunters made tools out of
material they gathered themselves. There was apparently little trading and no long-
distance movement between the geographically separated bands of Paleoindians.” The
author then goes on to state that the San Luis site contains tools made of types of rock
that are common in the area where this Folsom band lived (the Rockies).

   B: No. This choice is out of scope. While different bands, using only local materials, would have
used different rocks for their tools (which is given as support for the claim), the author does not
state or imply that each band created distinct tool shapes.

   C: No. The statement in this choice is inconsistent with passage information. The author indicates
that both the New Mexican and Coloradan Folsom people ate bison.

   D: No. This choice is out of scope. The only customs you know about from the passage are the
hunting and eating of game and gathering around a hearth, and these appear to be common to at
least many Folsom peoples. There is no information in the passage regarding language.

18. D  This is a New Information question.
   Note: All you know about animal bones from the passage is that bison bones were found at Folsom
sites and that evidence indicates that the Folsom people hunted and ate bison.

   A: No. The passage suggests the opposite. If the coexistence of bison bones and tools at Folsom
sites indicates that people hunted and ate those bison, a large number of deer bones found at
this Folsom site would certainly not suggest that those deer just happened to die “by accident” in
that same place.

   B: No. This choice is out of scope. While the discovery of deer bones in the same place where we
already know bison bones were found would suggest the coexistence of those animals while
alive, there is no reason to conclude, based on the question or the passage, that they would have
competed for food.

   C: No. This choice is out of scope. There is no basis on which to conclude that the deer came from
elsewhere.

   D: Yes. Bison bones were found at the site, and the author concludes that the Folsom people
ate bison. If deer bones were found in large numbers at the same site, it would be
reasonable to conclude that the Folsom people ate the deer.

19. A  This is a Strengthen question.

   A: Yes. The author has already argued that the presence of tools and animal bones at the
Folsom sites indicates that the Folsom people were hunters. If there was evidence that
these tools may have been used to break those animal bones, this would constitute even
more evidence for that hypothesis. This choice certainly does not prove the claim true (for
example, the tools could have been used to break bones after the animals died of natural
causes), but it goes the furthest of the four choices towards supporting it.

   B: No. This choice does not go far enough to “most strengthen” the claim. The lack of evidence that
the Folsom people had food sources other than bison may go a little bit towards strengthening the
claim that they ate bison, but it provides no evidence that they killed the bison that they ate.

   C: No. This is the right answer to the wrong question; it could be an excellent answer to an Inference
or Retrieval question, but not to this Strengthen question. To strengthen the claim, the answer
has to provide additional evidence. This choice simply repeats something that you already knew
from the passage to be true. Furthermore, as with choice B, it provides no evidence that the
Folsom people actually killed the bison themselves.
D: No. As with choice C, this statement repeats something you essentially already know to be true from the passage, rather than providing additional support for the hypothesis. Furthermore, like choices B and C, it does not suggest that the Folsom people actually killed the bison themselves.

Passage IV (Items 20-25)

Passage Text

P1 and P2: Biologists, especially Meselson, try to limit biological weapons.
P3: He learned and was horrified.
P4: Field Manual promoted biological warfare.
P5: Reasons why biological weapons should not be developed or used.
P6: Meselson convinced military that bio weapons have no reasonable usefulness.
P7: Meselson’s efforts successful.
Bottom Line: Meselson successfully fought for abandonment of bio weapons.

Questions

20. B This is a Retrieval question.
   A: No. This contradicts the first paragraph.
   B: Yes. The author states in the first paragraph that “biologists, with rare exceptions, never pushed the development of biological weapons” and that they encouraged governments to abandon such programs and destroy all such weapons.
   C: No. The author indicates that a large majority of biologists opposed biological weapons (there are only “rare exceptions”), not that it is 50/50.
   D: No. This choice is too extreme. The author does state in the first paragraph that there were “rare exceptions” to biologists’ opposition to biological weapons.

21. C This is an Inference question.
   A: No. The passage strongly indicates the opposite. Paragraph 4 describes how the Field Manual not only described biological warfare but suggested that “this is the way a modern army should be trained, that every country that wants to keep up with the Joneses must have its own biological agents and bomblets too.”
   B: No. This choice is half right but half wrong. Yes, the Manual indicated approval of the development of biological weapons, but no, it did not suggest that the use of bio weapons would NOT be logical. The Manual, as described in paragraph 4, expressed a very positive attitude towards all aspects of developing and using the capacity for biological warfare.
   C: Yes. Paragraph 4 describes the entirely positive attitude of the Manual towards the development and use of biological weapons.
   D: No. Paragraph 4 strongly indicates the opposite. The Manual said that “the United States was equipped and prepared for biological warfare, that this is the way a modern army should be trained, that every country that wants to keep up with the Joneses must have its own biological agents and bomblets too.”

22. B This is a Retrieval question.
   Note: Meselson’s questions to the generals are discussed in paragraph 6 as part of the author’s discussion of Meselson’s fight against the development and use of biological weapons.
   A: No. The issue raised by Meselson’s questions was the inappropriateness of the use of biological weapons for any purpose including retaliation, not the level of damage they would cause. Furthermore, this choice contradicts Meselson’s argument that biological weapons “provide opportunities for a small and poor country, or even for a group of terrorists, to do grave and widespread damage to a large country such as the United States” (paragraph 5).
   B: Yes. In the beginning of paragraph 4 the author mentions Meselson’s third question: “Did there exist any realistic military requirement for United States biological weapons?” The
questions asked of the generals were intended to show that the answer to this question was “No.”

C: No. This is inconsistent with Meselson’s position, which was that biological weapons should never be used, even in retaliation.

D: No. This is the opposite of Meselson’s position, which opposed any and all uses of, or investigations into the use of, biological weapons (see also paragraph 5 for a detailed account of Meselson’s argument as a whole).

23. B  This is an Inference/Roman numeral question.

Item I: True. The last paragraph states that Nixon announced “the destruction of our weapons stockpiles…”

Item II: True. The last paragraph states that Nixon “announced the unilateral abandonment of all development of biological weapons…”

Item III: False. This contradicts the final paragraph of the passage, where the author states that Nixon “announced the destruction of our weapons stockpiles…” That is, there would be no more old or existing weapons to use.

24. D  This is an Inference question.

A: No. Arguing that there is no rational use for these weapons is not the same as arguing that they do not work. Paragraph 5 in particular indicates that Meselson believed that biological weapons could in fact “work” quite effectively to kill large numbers of people.

B: No. This choice is out of scope; expense is never discussed in the passage.

C: No. This is the right answer to the wrong question. The passage does in fact indicate that Meselson would support the conversion of weapons labs to medical research labs that was announced by Nixon (paragraph 6). However, the claim that they should be converted was not a reason why Meselson opposed biological weapons. This choice essentially reverses the logic of the passage. The passage suggests that it was because of Meselson’s opposition to bio weapons that he would support conversion of the weapons labs.

D: Yes. This is directly stated in paragraph 5, where the author lists Meselson’s three objections to bio weapons. This one is the first of the three: “Biological weapons are uniquely dangerous in providing opportunities for a small and poor country, or even for a group of terrorists, to do grave and widespread damage to a large country such as the United States.”

25. D  This is a Retrieval question.

A: No. This choice is out if scope. The passage never mentions expense of weapons or defense budgets.

B: No. As with choice A, this answer is out of scope. While the passage does suggest that our own development of, and propaganda supporting, biological weapons could encourage other countries to develop them as well (paragraph 5), the author does not indicate that the possibility of starting an international disarmament trend was a motivation for the U.S. to abandon its biological weapons programs.

C: No. First, the final paragraph indicates that all such weapons held by the U.S. would be destroyed; none would be left to use for retaliation. Second, the relationship between the sixth and seventh paragraphs indicates that Meselson’s success in convincing the military that bio weapons should not be used even for retaliation led to the decision to abandon development programs.

D: Yes. The beginning of the sixth paragraph raises the question “Did there exist any realistic military requirement for United States biological weapons?” The rest of that paragraph describes Meselson’s successful argument that no, there did not. The final paragraph then describes the abandonment of all biological weapons research and the destruction of existing weapons. This suggests that it was the argument that the weapons serve no logical military purpose that led to the abandonment of those weapons.
Passage V (Items 26-30)

Passage Text

P1: Need to examine basis of Callas’s “greatness.” She was not truly responsible for revival of works.
P2: Allowed bad editing.
P3: Did not understand traditional performance practices like trill.
P4: Despite these failings, reputation based on her true authenticity.
Bottom Line: Callas had flaws but there was a truth to her singing.

Questions

26. B This is a New Information question.
Note: Make sure to translate the question. It is not asking how Callas herself would have presented the ballet. Rather, it is asking you to take the author’s apparent attitude and beliefs regarding editing revived operas to this new situation of presenting a ballet revival.

A: No. The author never indicates that works should be made easier to perform. In fact, he or she appears to value the “musical complexities” (paragraph 4) of Callas’s own performances.
B: Yes. The author’s criticisms of Callas’s unnecessary and destructive editing cuts (paragraph 2) and of her failure to follow appropriate tradition performance practices (paragraph 3) indicate that the author believes that revivals should stay fairly true to the original.
C: No. In paragraph 2 the author criticizes the fact that Callas allowed revivals of dormant operas to be “eviscerated, rearranged, and recomposed to the point that the hand of the composer was sometimes scarcely perceptible.” This suggests that the author would NOT like changes that modified the ballet’s original form.
D: No. This choice may be tempting. On one hand, the author does imply that some “particularly long and dreary sections of music” were unnecessarily retained in Callas’s performances, and the author states that Callas’s editing cuts failed to “really move the action forward as purported” (paragraph 2). On the other hand, however, the author here is largely criticizing Callas’s rationale for allowing bad editing. The author him or herself never recommends making changes to the original with the intent of keeping things moving.

27. A This is an Inference question.
Note: Make sure to keep track of the direction of the question. It is asking you to find the answer that is most inconsistent with the author’s claims or statements in the passage.

A: Yes. At the end of paragraph 2 the author describes these sections as “long and dreary.” This negative description is inconsistent with the positive view presented in this choice, that most listeners consider these sections to be beautiful.
B: No. Given that paragraph 2 indicates that these operas were edited specifically for Callas, there is nothing inconsistent between the passage and the view that these sections were left in to emphasize Callas’s voice.
C: No. While the passage states that they were left “largely untouched” (paragraph 2), the word “largely” implies that they were not completely untouched, and therefore that some edits were in fact made. These small edits could have been necessary (though perhaps not sufficient); this would not be inconsistent with anything in the passage.
D: No. The author states: “Yet inexplicably, long and dreary sections of music were retained in Callas’s performances largely untouched.” Given that this statement follows the author’s discussion of how the cuts that Callas did make or allow did not fulfill the intent of keeping the action moving, the word “inexplicably” suggests that these “long and dreary” sections did not keep things moving either. Thus, this view is not at all inconsistent with the passage.
28. D This is a Structure question. 
Note: The correct answer will be 1) a statement actually made in the passage but with 2) little or no support provided for it.

A: No. The author supports this statement at some length in the last paragraph. The author states that Callas combined “musical complexity and textual significance,” that there was little “acting” in Callas’s work, that “whatever she sang feels inevitable,” and that her work is a “transcendental probing of the music and an evocation of its inherent humanity.”

B: No. The author provides details in support of this claim in paragraph 2: “In addition to the removal of entire arias and scenes, the editing consisted of numerous smaller splices that ruined the phrase structure and obscured the original character of the music.”

C: No. The example of the missing “cadential trills” supports this claim in paragraph 3.

D: Yes. This claim—that Callas was the supposed defender of dormant traditions—is made at the end of paragraph 3. However, there is no support given for the claim (for example, how she defended them, what particular traditions she defended, why people she believed she defended them, etc.) either in this paragraph or in paragraph 1 where Callas’s reputation is also discussed.

29. D This is an Inference question.

A: No. This choice is too extreme due to the word “only.” The passage does mention “obvious and unwritten cadential trills,” but does not suggest that non-obvious cadential trills were always written. Don’t think too much about it or speculate about why cadential trills may or may not be written; just stick to the information provided in the passage.

B: No. The only cadential trills that are mentioned are unwritten ones. There is no evidence in the passage regarding where written trills may have been placed. This choice takes several words from the passage and mixes them up into a sentence that “sounds good” but has no textual support.

C: No. All you know from the passage is that Callas often omitted unwritten trills. You know nothing about other singers omitting written cadential trills.

D: Yes. The author states 1) that Callas often left out “obvious and expected unwritten cadential trills” and 2) that “the cadential trill was basic for all performers from the seventeenth century to at least the 1930’s.” From this you can infer that it was generally expected that these unwritten trills would be sung by performers.

30. C This is a New Information question. 
Note: Be careful to translate the question carefully. It is not referencing what the author means by “authenticity” (which the author sees as a positive thing), but what the term means as used in “historical performance circles” (which is quite different and fairly negative). According to paragraph 4, “In historical performance circles, the word has a bad reputation, often describing performances with correct external and musicological trappings that lack musical or artistic vitality and have a sense of the academy or the museum, rather than the stage.”

A: No. As the term is used in historical performance circles, it carries the idea of a performance that remains true in a strictly formal sense to the original. In this choice, the adaptation is NOT true in a formal sense to the original. Therefore, this is in part the opposite of what the relevant people would call “authentic.”

B: No. This would be inconsistent with what “historical performance circles” mean by authenticity. Reproducing feelings expressed in the original source would suggest some element of “vitality.” Note that this is essentially the opposite of what is suggested in correct answer C.

C: Yes. A lack of emotion would be consistent with a performance that “lack[s]...artistic vitality... .”

D: No. Make sure to keep track of whose point of view is referenced in the question. This would represent the author’s view of authenticity (see the end of the last paragraph), not the view of “historical performance circles.”
Passage VI (Items 31-36)

Passage Text

P1: 18th C. didn’t understand effect of disunity on war.
P2: Believed that inadequate navy caused British defeat.
P3: Bad decision-making by Cabinet was major problem.
P4: No one had clear plan.
P5: British complacency caused ignorance.
P6: Had no plan, and undermined by dissention at home.
P7: Politics over patriotism was major factor in British defeat.
Bottom Line: Lack of unity and decisiveness caused British defeat.

Questions

31. C  This is an Inference question.
A: No. The passage does not suggest that the military was not “allowed to fight in force”; that is, the author doesn’t indicate that the military was intentionally held back in any way. While the author does identify “complacency” as a factor, she argues that this resulted in ignorance and thus lack of planning (the belief, for example, that all that was needed was “hard knocks”), not that full forces weren’t committed to the war effort.
B: No. This choice is out of scope. While the British may have believed that defeating the Americans would be easier than it turned out to be, the expected length of the war is not given as a factor in the British defeat.
C: Yes. In paragraphs 3, 4, and 6 the author identifies lack of planning as a significant factor in the British defeat. This, you can infer that they might have won the war with good planning.
D: No. In paragraph 4 the author describes King George as incapable of making a “decisive determination” regarding focus and priorities. Therefore, it seems unlikely that putting him more firmly in charge would have led to a British victory.

32. D  This is a Retrieval question.
A: No. This choice is out of scope. The passage does not suggest that the British either surprised or believed they could surprise the Colonists in any way.
B: No. Paragraph 6 suggests the opposite. The British were overconfident to the point that they didn’t think that they needed to “take pains in performance” of a clear strategy.
C: No. This choice is out of scope. At no point does the passage suggest that the British believed that the Colonists would refuse to fight; they just thought that the Colonists could be easily overwhelmed by British forces (paragraphs 2 and 6).
D: Yes. The author states in paragraph 6 that “Carelessness followed from the assumption that the superiority of British force was so great that it made taking pains in performance unnecessary.” [emphasis added]

33. B  This is a Retrieval/Roman numeral question.

Item I: False. The author states the opposite in paragraph 4: “While George III had no trouble making up his mind, it contained only one idea.…”
Item II: True. In paragraph 4 the author discusses the lack of coherent planning in the part of the British and writes: “While George III had no trouble making up his mind, it contained only one idea—to conquer, but not how.”
Item III: False. In the course of paragraph 4, where she discusses the lack of British planning, the author writes: “While George III had no trouble making up his mind, it contained only one idea—to conquer, but not how.” That is, George III did NOT have a detailed plan of how to win the war.
34. A This is an Inference question.
A: Yes. In the last paragraph the author states that “Politics as much as anything defeated the British in the American war” because it created factions and divisions that undermined the war effort. In the first paragraph the author indicates that “the presence of disunity...makes it impossible for a war of any duration to be fought effectively and won.” The conclusion that “politics often detracts from a war effort” would be consistent with these statements.
B: No. This choice is out of scope. Settlement by treaty is not mentioned in the passage. Furthermore, the American colonists won through military action, indicating that settlement by treaty was clearly not the only option for them.
C: No. This choice is out of scope. The issue of deciding whether or not a war is justified is not a theme in the passage. Nor does the passage indicate that a leader should delegate strategy to others (including the military); the passage suggests that part of the problem for the British was that George III did not exert enough focused control over the war effort (and nor did anyone else).
D: No. This choice is out of scope. The passage never discusses the value or effect of compromise.

35. A This is a Retrieval question.
A: Yes. In paragraph 5 the author states that “the danger in complacency” is that complacent people don’t bother to gather information about others, in this case about colonial Americans. The author goes on to say that for the British, “[t]he consequence was ignorance, which is a disadvantage in war.”
B: No. This choice is out of scope. The passage never indicates that complacency on the part of the British (or anything else) led to a build-up of colonial forces.
C: No. This is the right answer to the wrong question. The author states that there was in fact rivalry between British factions (paragraphs 1 and 7), but not that complacency caused this rivalry.
D: No. If anything, the passage suggests the opposite. To the extent that the American colonies could be seen as a base for British imperial power, complacency contributed to the British loss of that base (paragraph 5).

36. B This is an Inference question.
A: No. This choice is out of scope. War-related technology is never discussed in the passage.
B: Yes. This conclusion is supported throughout the passage. For example, paragraph 1 raises the problem of disunity, paragraphs 2-6 describe the problematic perception on the part of leaders that no real efforts to gain information or to come up with a coherent strategy were needed, and paragraph 7 returns to the theme of the problems created by factionalist and divisive attitudes.
C: No. While this choice makes common sense in terms of outside knowledge, it is out of scope. The passage never discusses the importance of mobilizing quickly.
D: No. As with choices A and C, this choice is out of scope. The author never raises moral issues.

Passage VII (Items 37-42)

Passage Text

P1: Despite common belief, metaphor is part of daily life.
P2: Metaphorical concepts define our reality.
P3: Normally unaware – to understand, look at metaphor in language.
P4: Most ordinary concepts metaphorical and can identify them.
P5: Example of “argument as war”
P6: The concept structures our behavior.
P7: Culture with different metaphors would perceive and behave differently.
Bottom Line: Metaphors significantly affect our daily lives.
**Questions**

37. **C** This is a Main Idea question.

- **A**: No. While this statement is supported by the first sentence of paragraph 3, it is too narrow to be the main thesis of the entire passage. The passage as a whole is about what we can come to understand about our conceptual systems, not that we are largely unaware of them.

- **B**: No. As with choice A, this statement is supported by the passage (paragraph 7), but is too narrow to be the central thesis. The fact that an argument can be seen as either a war or a dance is given as an example of the more general power of metaphorical concepts.

- **C**: Yes. All of the main points within the passage are in support of this statement. In the first paragraph the author states that “metaphor is pervasive in everyday life” and that our “ordinary conceptual system...is fundamentally metaphorical in nature.” Paragraph 2 states that “our conceptual system...plays a central role in defining our everyday realities,” and the rest of the passage provides evidence for this claim.

- **D**: No. As with choices A and B, this statement is supported by the passage (first sentence of the text) but too narrow to be the central idea of the passage as a whole. Most of the passage discusses how metaphor goes beyond poetic or rhetorical “extraordinary language” to play a fundamental role in our ordinary, everyday lives.

38. **C** This is a New Information question.

*Note: The nature of the new information should make you think of the examples in the passage of metaphorical expressions we use to describe arguments in terms of war (paragraph 5). The author cites those examples in order to make the point that the nature of our metaphors indicates the nature of our perception of reality. Therefore, you are looking for a similar theme or idea in the correct answer.*

- **A**: No. While one could say that this is literally true based on the four expressions given, this is not relevant to any claims made in the passage (as required by the question stem).

- **B**: No. Nothing in the new information in the question or in the passage text deals with a *desire for more* of anything. The correct answer needs to be relevant to both the new information and the passage text, and this choice is directly relevant to neither. It is also useful to notice the strong word “most” in this choice. Even if you are thinking that two of these four expressions literally indicate a problematic lack of energy (and so perhaps an implied desire for more), this still would not support the idea that a majority of people wish they had more energy.

- **C**: Yes. All four of the expressions given in the question have quantity words: “brimming, overflowing, devoid, don't have any.” According to the passage, the conceptual metaphors that appear in our language also structure our perception of reality. Therefore, you can conclude that these sayings suggest that people think of energy or vitality as a physical substance that we can have more or less of.

- **D**: No. This choice tries to tempt you by including something familiar (the example of our concept of arguing) from the passage and combining it with the new idea in the question stem (energy). However, nothing in the expressions given in the question stem, or in the discussion of our metaphorical concept of arguing in the passage, suggests such a connection.

39. **B** This is a New Information question.

*Note: Use the examples given in the passage (of sayings that suggest that we metaphorically see arguments as war) to help you to interpret this new saying. If the speaker is thinking of arguments as something that you win or lose, then you are looking for a guiding metaphor in the answers that would have that same theme.*

- **A**: No. There is no suggestion of violence in the statement “I've never won an argument with him.”

- **B**: Yes. You win or lose contests, and this speaker sees arguments as things you win or lose. Therefore, you can reasonably conclude that he or she sees arguments as contests.

- **C**: This is the right answer to the wrong question. Yes, the author would agree that conceptual systems are metaphorical, but there is no reason to think that the speaker in the question would be thinking the same. Note also that there is no reference in this choice to arguing.
D: No. This choice is half right but half wrong. Yes, there is a theme of competition, but no, there is no suggestion of unpleasantness. This choice, like choice C, is also missing any reference to arguments.

40. A This is an Inference question.
   A: Yes. This choice is supported by the final paragraph of the passage. An understanding of how different cultures may see the “same” thing (such as an argument) in very different ways would help an ambassador understand and communicate within a foreign culture.
   B: No. This choice is a trap for test takers who do not see that the author’s discussion of arguments is offered as an example of the larger point. There is nothing in the passage that would help someone perform better in a debate.
   C: No. This choice is out of scope. There is nothing in the passage to suggest some relevance of the idea of culturally specific metaphorical concepts to financial analysis or to working in large corporations.
   D: No. This choice is similar to choice B in that it takes part of an example, in this case the concept of war, out of context. Nothing in the passage would help someone in a literal war.

41. A This is a New Information question.
   Note: As with question 39, use the examples of metaphorical statements given in the passage to figure out what the question is asking and what the correct answer needs to do. For example, according to the author the statement “He shot down all my arguments” (paragraph 5) indicates that we see arguments in terms of war (since there is shooting in war). Therefore, if I used the expression “This is driving me around the bend” to indicate something about madness, it would suggest that I see madness as conceptually comparable to being “around the bend.”
   A: Yes. “Around the bend” would be a location; that is, a place that exists on the other side of a corner or bend in the road.
   B: No. Madness would be the resulting “location,” not what drove or carried me to that location.
   C: No. This choice is tempting, but it doesn’t match the expression. “Around the bend” would be a particular place in the road, not the whole road itself.
   D: No. The “This” in the expression could be a force driving me around the bend to madness, but it would not be the madness itself.

42. B This is a Retrieval question.
   A: No. The passage suggests the opposite. Attacking an opponent’s weaker points would be the way to respond within a culture that saw arguments as battle. This would not work so well, however, in a culture that expected an argument to be “balanced and aesthetically pleasing” (paragraph 7).
   B: Yes. This choice, out of the four options, corresponds best to the “balanced and aesthetically pleasing” undertaking (paragraph 7) that would be expected by someone from a culture that sees arguments as a dance.
   C: No. Nothing in the passage indicates that we should try to dissuade people from their existing cultural metaphors. Rather, the passage indicates that we should have respect for cultural metaphorical diversity.
   D: No. This is an interesting position, but the author never advocates irrational defense of our own points of view. Rather, he suggests that we should understand and respect different perspectives on reality.
Passage VIII (Items 43-47)

Passage Text

P1: Entering into a new socioeconomic hierarchy has consequences, including connections to relationship between status and psychological problems.
P2: Social stress and mental health problems most intense at bottom of socioeconomic hierarchy, which is entry point for many immigrants.
P3: Ability of immigrants to transfer socioeconomic advantages to children depends on variety of factors.
P4: Immigrants often have to take lower-status employment.
P5: Standard stress models inadequate. Immigrants may have positive as well as negative experiences.
P6: Changes due to migration are complex and deep, and current social-stress models cannot fully explain.

Bottom Line: Immigration entails a variety of complicated factors relating to social stress and status which current social stress models cannot fully explain.

Questions

43. A  This is a New Information question.
   A: Yes. The author indicates in paragraph 5 that immigrants who were forced to change profession found new opportunities and came to appreciate their new careers. Therefore, the author would most likely advice someone in this situation to try to make the best of it in a similar way.
   B: No. The immigrants described in the passage who had to find lower status employment (paragraphs 4 and 5) found satisfaction in different aspects of their new jobs, other than the status or respect attached to the job. Therefore, there is no basis on which to conclude that the author would recommend searching for a job of equivalent status.
   C: No. As with choice B, there is no evidence from the passage that the author would recommend trying to find some kind of close equivalent to one’s old job. Rather, he would recommend finding a new and perhaps quite different job (such as going from a doctor to a newspaper seller (paragraph 4)) that may offer entirely new advantages.
   D: No. This choice is out of scope. Make sure not to speculate about what might be necessary in order to find a new lower-status job; nothing in the passage suggests a need for secrecy or concealment.

44. D  This is an Inference question.
   A: No. This is the right answer to the wrong question. While the author does indicate that many immigrants expect their children to achieve a higher status (paragraph 3) this is not given as a factor that makes adjustment particularly difficult.
   B: No. Make sure not to use outside knowledge or opinion. While the passage indicates that immigrating to a new culture may entail “adaptations so profound” that they can be seen as a “second birth” (paragraph 6), the author does not suggest that this is unexpected or surprising to immigrants.
   C: No. Again, make sure not to use outside knowledge. The author never discusses racial prejudice on the part of employers. The only hint of potential effects of racism in the passage is the mention of Australia’s “racially restrictive immigration policy” that was discontinued in 1972 (paragraph 4). However, this was a policy enacted by the government, not by employers.
   D: Yes. In paragraph 2, in discussing the geometrically inverse relationship between socioeconomic status and stress, the author states: “At the bottom of the stratification heap, any source of stress seems to be pervasively disruptive in its effects.” “Any sort of stress” would correspond to “particular problems” in the answer choice, and “something that is “pervasively disruptive” would affect many aspects of a person’s life. This statement regarding the poorest immigrants is made in the general context of the author’s argument regarding challenges entailed in adapting to a new society.
45. **B** This is a Weaken question.
A: No. The author argues that stress is inversely related to status (paragraphs 1 and 2), but does not indicate that all immigrants are low status. Therefore, the finding that not all immigrants experience an increase in stress is not enough to weaken the author’s argument—these could, for example, be higher-status immigrants.
B: Yes. The author argues in paragraphs 1 and 2 that there is an inverse relationship between social status on one hand, and social stress and mental health issues on the other. Thus, you would expect those with the lowest status to have the highest stress. If those with the lowest status experience the least amount of stress, as stated in this choice, it would directly challenge the author’s claim.
C: No. This choice is out of scope, and it takes the author’s use of the term “social” out of context. The author is discussing placement within a socioeconomic context, not a “social” interaction between individuals.
D: No. This choice is tempting, as it is somewhat inconsistent with the author’s discussion of downward mobility in paragraph 4. However, the author goes on to indicate that many who have to take on lower status jobs eventually find satisfaction in their new careers (paragraph 5). Therefore, this part of the passage is not a central part of the author’s discussion of adaptation difficulties, and this choice does not significantly weaken the author’s claim.

46. **A** This is a Retrieval question.
A: Yes. See paragraph 4, where the author argues that in Australia “institutional barriers, epitomized for a bureaucratic apparatus for the official recognition of professional qualifications, kept emigrants from exercise their skills….. .” The paragraph goes on to describe immigrants with professional qualifications from their home countries who had to abandon their former careers and take on lower-status jobs.
B: No. This choice is out of scope; the author never discusses education levels or lack of education as a factor. Furthermore, if one assumes that someone with professional credentials as a doctor or teacher or accountant would be reasonably well educated, this choice actually contradicts the passage, as such people were often prevented from “exercising their skills” and had to take lower status jobs (paragraph 4).
C: No. This choice is too extreme. While the author does indicate that many immigrants will have trouble adapting, and that those at the lowest socioeconomic level are most likely to experience high stress and mental health problems, that author does not connect this to how actively a person seeks employment.
D: No. Make sure not to use outside knowledge or personal opinion. While this statement seems reasonable, there is no discussion of language barriers in the passage.

47. **A** This is a New Information question.
A: Yes. An immigrant’s income could reasonably be seen as one indicator of social status, and there is no suggestion in the passage that the author would argue that social stress is the only factor. In fact, the author argues in the last paragraph that factors that relate to adaptation are very complex, and that existing social stress models are inadequate. Therefore, the author would most likely accept assertiveness as another factor in immigrant adjustment.
B: No. This choice is out of scope. The author never discusses labor unions.
C: No. This statement is inconsistent with various parts of the author’s argument in the passage, including his discussion in paragraphs 4 and 5 of how the lack of the right professional I credentials may force an immigrant to take a lower-status job. The author would therefore not agree that the ability to communicate determines job prestige.
D: No. This choice is out of scope. There is no evidence from the passage that would suggest that employers would interpret assertiveness as indicating high status.
Passage IX (Items 48-53)
Passage Text

P1: Imagination is unique to all humans.
P2: Human imagination involves imagery.
P3: Images are not only visual.
P4: Most important images are words. Only humans have evolved capacity for language and imagery.
P5: Imagination connects us, unlike animals, to past and future.
P6: Should appreciate imagination as a gift.
P7: Use of imagination not limited to literature.
P8: Uniquely human capacity to make and use images is source of all science and literature.
Bottom Line: All humans and only humans have the great gift of imagination.

Questions

48. B  This is a Retrieval question.
   A: No. Both parts of this choice contradict the author’s discussion, particularly in paragraphs 3 and 4. In paragraph 3 he states “I am using the word image in a wide meaning, which does not restrict it to the mind’s eye as a visual organ.” The author then goes on in paragraph 4 to argue that “the most important images for humans are simply words, which are abstract symbols.”
   B: Yes. The author indicates in paragraph 3 that the image can be, but does not have to be visual. In paragraph 4 he argues that “the most important images for humans are simply words, which are abstract symbols.” Thus images can be either visual or abstract.
   C: No. See paragraph 3. While images do not have to be visual, they can be.
   D: No. See paragraphs 3 and 4. Images can be either visual or abstract.

49. A  This is a New Information question.
   A: Yes. The author discusses the difference between animals and humans in paragraphs 4 and 5. In paragraph 5 he argues that images connect humans to the past and future, and that “By contrast, the lack of symbolic ideas, or their rudimentary poverty, cuts off an animal from past and future alike and imprisons him in the present.” Therefore it would be reasonable to assume that dogs cannot remember the past as well as humans because dogs have relatively little capacity for symbolic thought.
   B: No. While the author does discuss the relevance of the evolution of the human brain, relative speed of evolution is not presented as a factor in humans’ greater symbolic capabilities.
   C: No. This choice is out of scope. The author indicates that humans and animals have different innate capacities, regardless of the age of the individual.
   D: While this statement may be factually true, it has no relevance to the issue of symbolic thought; there is no suggestion in the question that the “signal” was both visual and involved color.

50. A  This is a Weaken question.
   A: Yes. This statement would most undermine the author’s argument in paragraphs 4 and 5. In paragraph 4 the author argues that “the most important images for human beings are simply words, which are abstract symbols. Animals do not have words, in our sense: there is no specific center for language in the brain of any animal, as there is the human being.” The author goes on to continue this argument in paragraph 5, which is where he states that “the lack of symbolic ideas, or their rudimentary poverty, cuts off an animal from past and future alike and imprisons him in the present.” However, if chimps are capable of learning some sign language, this constitutes evidence that some animals are capable of abstract and symbolic thought. Thus this capacity would NOT be unique to humans.
   B: No. This choice is out of scope. Birds’ ability to migrate by instinct provides no evidence that these birds, or any other animals, are capable of symbolic imagery
   C: No. This choice is entirely consistent with the author’s argument. The author himself states in paragraph 3 that “evolution has greatly enlarged the front lobes in the human brain…and it is a fair guess that they are probably the seat of our other images.”
D: No. The author does not base his argument on total brain size, nor does anything in the passage indicate that the larger the brain, the greater the capacity for symbolic thought. This choice has no effect on the author’s argument.

51. D This is a New Information/Strengthen question.
Note: The question asks what statement already made in the passage most supports the new claim cited in the question stem. Therefore, you are not judging the choices based on how well supported they are BY the passage, but by how well THEY support the new claim that language helps to bring reality into existence.

A: No. here is nothing in this statement connecting imagining reality to making it come true.
B: No. As with choice B, there is no connection in this statement to the issue of “helping to bring reality into existence.”
C: No. There is no indication here that the unique human capacity for language plays any role in making things that we have imagined actually happen.
D: Yes. If images, by playing out events that have not happened yet “create the future,” this strengthens the claim that language (which according to paragraph 3 consists of images) helps bring reality into existence. While this might sound like fairly vague and abstract support, this is the only choice that has any connection to the relevant theme in the new information.

52. B This is an Inference question.
Note: Sidney makes this claim in paragraph 6. Sidney’s point is that poets are not lying by saying something that is not true. Rather, they are saying something that will become true in the future because the poet had the capacity to imagine it. Note that the quote from Blake says essentially the same thing; if you understand the Blake quote, it can help you to better understand what Sidney had in mind.

A: No. The issue here is not what is necessary for a true poet, but rather the creative power of the imagination to bring things out of the imagination and into reality.
B: Yes. This is the only answer choice that contains this idea that imagining something may help to eventually make it come true.
C: No. This choice is too extreme (“most creative people”). Furthermore, it has no thematic connection to the Sidney quote.
D: No. This is the right answer to the wrong question. While the author would certainly agree with this, the question asks what Sidney meant. Sidney was speaking specifically about poets and in particular about the capacity of the poetic imagination to make what was once only imagined become real.

53. B This is an Inference question.
A: No. This choice has the wrong tone. It presents the imagination in a negative light, while the author is strongly positive on the subject.
B: Yes. This is a reasonable paraphrase of the statement (i.e., the bad is balanced off by the good) and it carries the positive tone expressed by the author.
C: No. As with choice A, this answer has a negative tone, which is inconsistent with the author’s positive attitude towards the imagination, as expressed in the passage.
D: No. This choice takes words from the passage out of context. The author does not mean “die a thousand deaths” to be taken literally in terms of awareness of actual physical death or any necessary condition for that awareness. The theme in the passage is that while we may imagine thousands of terrible things, our capacity to do this also gives us the capacity to imagine thousands of good ones, and the opportunity to lead rich and full lives.
BIOLOGICAL AND BIOCHEMICAL FOUNDATIONS OF LIVING SYSTEMS SOLUTIONS

Passage I (Items 1-5)
1. **C** The passage states that “the Arf1 GTPase activating protein (GAP) catalyzes the conversion of Arf1-bound GTP to GDP and inorganic phosphate, thereby converting the protein to the inactive form (choice C is correct and choice B is wrong). Nothing in the passage suggests that the protein is denatured or associated with the membrane on dephosphorylation (choices A and D are wrong).

2. **A** GTP is guanosine triphosphate, a nucleotide (choices B, C, and D can be eliminated).

3. **B** GAP is described in the passage as the GTPase activating protein, and its action is to remove a phosphate from GTP. This is the action of a phosphatase (choice B is correct). Transferases move functional groups from one molecule to another (choice A is wrong), kinases add phosphates to molecules (choice C is wrong), and isomerases rearrange molecules (choice D is wrong).

4. **A** Arf1 is described in the passage as playing an important role in “the recruitment of cytosolic coat protein complexes (COPs) and subsequent retrograde transport from the Golgi apparatus”. Since typically proteins travel from the ER to the Golgi to the membrane or other structures, retrograde (meaning in reverse) from the Golgi must return proteins to the rough ER (choice A is correct and choices B, C, and D are wrong).

5. **A** The passage describes the action of BFA as “reversible disruption of the Golgi apparatus”. Since only eukarya have Golgi apparatuses, only they would be affected (choice A is correct). Neither viruses, bacteria, nor archaea have Golgi apparatuses, so they would not be affected (choices B, C, and D are wrong).

Passage II (Items 6-10)
6. **B** The hypothesis in the passage is that neutrophils are the cause of the tissue damage; thus testing animals lacking neutrophils and comparing their results to the results from the passage (obtained from animals with neutrophils) would be the best way to gather supporting evidence (choice B is correct). Performing the experiment with B-cell depleted animals would give information about B-cells but not neutrophils (choice A is wrong). Repeating the experiment with different antibodies would render similar results to those already obtained (choices C and D are wrong, particularly choice D which is essentially a replication of the experiment in the passage).

7. **A** The passage describes the alpha-beta heterodimer as an “adhesion receptor”. Additionally, the inactivation of the beta subunit by the antibodies prevents tissue damage, thus must have prevented neutrophil adhesion (choice A is correct). No mention is made of the heterodimer or the beta subunit transferring proteases (choice B is wrong). While the passage does state that the beta subunit noncovalently associates with the alpha subunit, and while this could be hydrogen bonding, this is not really the function of the beta subunit, just one of its properties (choice C is wrong). Antibody production is the function of B-cells, not adhesion receptor subunits (choice D is wrong).

8. **B** Anything that prevents the initiation of damaging pathways is going to be more effective than allowing the pathway to start and then trying to fix the problems it causes (choice B is correct). The passage says nothing about the affinity of the antibody, and nothing about possible rejection (choice A is wrong), and also nothing about half-life (choice D is wrong). Note that while choice C is a true statement, it does not answer the question (choice C is wrong).
9. **B** The antibody in the passage was generated in a mouse, and is therefore a foreign protein to a human. Injection of the mouse antibody into a human would result in an immune response and the production of human antibodies against the mouse antibody. It might be OK one time, but subsequent uses would result in stronger and stronger responses (choice B is correct and choice A is wrong). If the human antigen and mouse antigen are sufficiently similar, the mouse-generated antibody could recognize both (choice C is wrong). The mouse antibody was used successfully in mice (choice D is wrong).

10. **C** The passage states that migration occurs after adherence, so if the neutrophils can still migrate, they must be able to bind to epithelium (choice C is correct). If they can adhere and migrate, they can likely still release toxic products (choice A is unlikely). We don't know much about the effects of the alpha subunit and so cannot say with certainty that only the beta subunits are functional; in fact if the neutrophils are adhering and migrating, it would suggest that both subunits are functioning in spite of their mutations (choice B is wrong). We cannot draw conclusions about the cell membrane based on mutations in the alpha and beta subunits (choice D is wrong).

**Passage III (Items 11-14)**

11. **C** The question asks which inheritance pattern *fails* to support the idea that all hemophiliac mutations are strictly X-linked. Item I is false: if the mutations are all on the X, then a hemophiliac father can have normal sons, as the sons inherit their Y from their father not their X (Item I supports the X-linked hypothesis and can be eliminated). Choices A and B can therefore be eliminated. Note that the remaining choices both include Item IV so it must be true: a normal father has a normal X and would pass that normal X on to his daughters. Since the alleles are recessive, the daughter would have to inherit two abnormal X chromosomes to become hemophiliac, one from her father and one from her mother. If a hemophiliac daughter is born to a normal father, it suggests that the genes for hemophilia must be located somewhere other than the X chromosome (Item IV *fails* to support the X-linked hypothesis and is true). Item II is true: since hemophilia is recessive, if it is strictly X-linked, then hemophiliac mothers must have two recessive X chromosomes and could only pass the defective gene on their sons; all of their sons would thus be hemophiliac. If they have normal sons, it suggests that the genes for hemophilia must be somewhere other than the X (Item II *fails* to support the X-linked hypothesis and is true). Choice D can be eliminated and choice C is correct. Note that Item III must support the hypothesis and it does: if hemophilia is strictly X-linked, then the son could inherit the recessive X from his mother and be hemophiliac even if his father is normal.

12. **C** The best support for the claim that Factor VIII is functionally deficient in hemophiliacs is to give hemophiliacs normal Factor VIII and see if it fixes the problem. Since it does, the hemophiliac's Factor VIII must be deficient (choice C is true). Just because it is a soluble blood protein, or because it is on the X chromosome, or because it has introns does not mean it is deficient. Lots of things are soluble blood proteins, or are coded for on the X, or contain introns and they are not deficient (choices A, B, and D are wrong).

13. **A** The first transcript produce by RNA polymerase include both introns and exons and is termed "heterogeneous nuclear RNA" (hnRNA). This hnRNA is then subject to splicing and other processing to form mature mRNA (choice A is correct). tRNA is not expressed (choice B is wrong), mRNA is not used to synthesize tRNA (choice C is wrong), and although tRNA is involved in protein synthesis, it is mRNA, not tRNA, that is read to produce protein (choice D is wrong).

14. **D** Bacteria can be used to express human proteins, but must be provided with the mature (already spliced and processed) mRNA. Their own genes are not spliced and processed in this way, thus they lack the mechanisms to do so (choice D is correct). None of the other choices really apply; bacteria are perfectly capable of producing proteins even though they are small and do not have either an X chromosome or a nucleus; in other words, these things do not prevent protein synthesis (choices A, B, and C are wrong).
Freestanding Questions (Items 15-18)

15. A When looking to explain why weak acids nearly fully dissociate in the blood, but would not in pure water, the existence of other proton-accepting ions in solution is an attractive solution. The blood is a highly buffered solution, meaning excess protons are pulled from solution by buffer ions. This process pushes the dissociation for the weak acid to near-full-dissociation by Le Châtelier’s principle. Choice C is a correct statement; the ionic strength of blood is higher than pure water. However, this fact, in the absence of a particular interaction with either the H\(^+\) cation or A\(^-\) anion does not explain the result that seems to defy thermodynamics (choice C can be eliminated). Choice D postulates that the dissociation is catalyzed, which would not affect the equilibrium dissociation (a thermodynamic, not kinetic quantity), so choice D is eliminated.

16. A Cytochrome c is a heme protein in the electron transport chain. Its iron center cycles between a ferrous (Fe\(^{2+}\)) state and a ferric (Fe\(^{3+}\)) state. Thus this molecule can only move a single electron at a time.

17. D This is an ambiguous question at best. PCR primers are typically constructed very specifically to base pair with the DNA flanking the region of DNA to be amplified. However, if the primers are to be constructed to bind randomly, then the best choice would be primers that have an equal amount of G-C and A-T base pairs. G-C pairs require higher temperatures to separate and anneal because they utilize three hydrogen bonds to connect, whereas A-T pairs only use two. Of the choices given, only choice D has an approximately equal number of G-C and A-T pairs; all other choices have more A-T than G-C.

18. A Nondisjunction is the failure to properly separate DNA during gamete formation, or meiosis. This can only occur during the phases when DNA is actually being separated; anaphase I (homologous chromosomes are separated), or anaphase II (sister chromatids are separated).

Passage IV (Items 19-22)

19. B The structure of the modified nucleotide shows an adenine as the base, bonded to the amino acid threonine (side chain –CH\(_2\)CH\(_2\)OH). Tyrosine and tryptophan both have ring structures in their side chains (choices A and D are wrong), and lysine has a nitrogen atom in its side chain (–CH\(_2\)CH\(_2\)CH\(_2\)CH\(_2\)NH\(_3\)+, choice C is wrong).
20. D The passage states that inaccurate translation of the codon results in a loss of luciferase activity, thus the lowest luciferase activity in Figure 2 represents the highest level of mistranslation of the codon. The ΔyeqE strain shows lower activity than the wild-type strain (choices A and C can be eliminated), and the AAG codon shows lower activity than the AAA codon (choice B can be eliminated and choice D is correct).

21. C The final step in insulin processing is the removal (cleavage) of the C-peptide. Figure 3 in the passage shows that amount of C-peptide is lower in CDKAL1-deficient mice than in wild-type mice, indicating that cleavage of proinsulin is reduced, not increased (choice A can be eliminated). Figure 4 shows that CDKAL1 deficiency leads to a decrease in the synthesis of proinsulin, not an increase (choice B can be eliminated). There is no information regarding the ratio of wild-type of variant proinsulin (choice D can be eliminated). The most likely effect of CDKAL1 deficiency is an increase in misfolded insulin, due to the mistranslation of the lysine codon (choice C is correct).

22. A Wild-type mice synthesize more proinsulin than CDKAL1-deficient mice (note that proinsulin is a protein, choice D is wrong) especially during stimulation by glucose (see Figure 4). They also process more proinsulin to insulin than CDKAL1-deficient mice (see Figure 3). Since insulin lowers blood sugar levels, in a nonfasting state, wild-type mice would have lower blood glucose levels than the CDKAL1-deficient mice (choice A is correct). Cellular glucose uptake would be higher in wild-type mice due to the presence of insulin (choice B is wrong), and liver glycogen synthesis would also be higher, due to the uptake of glucose (choice C is wrong).

**Passage V (Items 23-27)**

23. A The transport capacity is irrelevant in this case because the question specifies “low-food conditions”. Under these conditions, the transporters would not be saturated (i.e., operating at transport capacity, choices C and D can be eliminated). Under low-food conditions, the transporter’s affinity for L-alanine would play a much more important role; high-affinity transporters would be more effective at facilitating L-alanine uptake than low-affinity transporters (choice A is correct and choice B is wrong).

24. C The affinity of a transporter for its amino acid is not affected by the concentration of the transporter itself. This is similar to enzyme kinetics; the affinity (K_m) of an enzyme for its substrate is not affected by the concentration of the enzyme. Thus, changing the concentration of the transport protein will lead to no change in the transport affinity, K_t (choices A, B, and C are wrong).

25. B In Michaelis-Menten enzyme kinetics, K_m is equal to the substrate concentration at which the reaction rate is ½ V_max. Thus K_i would be the substrate concentration (choices A and C are wrong) at which the transporter is operating at ½ the maximal transport capacity, J_max (choice B is correct and choice D is wrong).

26. D All animal amino acids have the L configuration, thus D-alanine would not be able to be incorporated into new proteins. Protein synthesis would be inhibited (choice D is correct and choices A, B, and C are wrong).

27. C The passage states that “survival in nutrient-poor water column is likely enhanced if animals have low rates of utilization of cellular energy reserves”. The average metabolic rate is an indicator of use of cellular energy reserves; therefore, knowing an animal's average metabolic rate would be a good predictor of its ability to survive in nutrient-poor water (choice C is correct). The ambient water temperature is irrelevant, as both the warm-water and cold-water species seem to be surviving (choice A is wrong). While the mass of an individual animal might predict increased energy reserves, this is also irrelevant if the rate at which those reserves are used is very high.
Freestanding Questions (Items 28-31)
28. **C** Reproduction requires energy (ATP), so the more ATP an organism can generate, the faster its growth rate will be. Aerobic conditions allow the production of substantially more ATP (choices A and B are wrong). CO2 is produced in both fermentation and aerobic conditions; if it were toxic in fermentation, it would also be toxic in aerobic conditions (choice D is wrong and choice C is correct).

29. **B** Bacteria (in fact, all organisms) do not express all genes at all times, only the ones that are necessary at that moment. The addition of the polysaccharide represents a change in the bacteria’s environment and they respond to it by turning on expression of the genes for the enzymes to digest that polysaccharide. Digestion of the polysaccharide provides energy, leading to increased growth (choice B is correct). Bacterial colonies are clones of each other, if one bacterium can digest the polysaccharide, then all of them can; there would not be two types of bacteria in one colony (those that can and cannot digest the polysaccharide). And even if there were, the death of some bacteria does not explain why the others have a delay in their growth curve (choice A is wrong). A polysaccharide was added (a sugar), not a fatty acid (choice C is wrong), and there is no reason to assume inhibition of bacterial fission, as growth is occurring (choice D is wrong).

30. **A** DNA containing genes that are being expressed (transcribed) is less tightly packaged than DNA not undergoing transcription. Because it is less tightly packaged, it stains less darkly (euchromatin) than tightly packaged DNA (heterochromatin, choice A is correct and choice C is wrong). Telomeres are repetitive sequences at the ends of chromosomes and typically do not contain protein coding regions (choice B is wrong), and centromeres are densely packaged DNA at the center of a chromosome that holds the two sister chromatids together during replication. It typically contains genes for kinetochore formation and assembly, which are only expressed during cell division (choice D is wrong).

31. **A** The question states that the amino acid has two nitrogen atoms in its formula; tyrosine has only one in the backbone (choice C can be eliminated), and arginine has four (one in the backbone and three in its side chain, choice D can be eliminated). Since the N-terminus and the C-terminus of any amino acid will be charged at pH = 7, the answer will be the amino acid that has an uncharged R group at the same pH. The primary amine in the R group of lysine is far too basic for this, and will be protonated (choice B is wrong). The amide in the R group of glutamine is not as basic, and is neutral at pH = 7 (choice A is correct). The amide in the R group of glutamine is not as basic, and is neutral at pH = 7 (choice A is correct).

Passage VI (Items 32-35)
32. **D** The passage states that “antigenic variation is a survival strategy…to avoid destruction by the host’s immune system” (choice D is correct). Nothing is mentioned about the uptake of the parasite by erythrocytes, and in any case, reducing the uptake would not be a benefit since the parasite lives inside erythrocytes (choice A is wrong). Jasplakinolide is mentioned in the passage as an actin stabilizer that enhances expression; reduction of the sensitivity to jasplakinolide would not be an advantage. Further, the presence of jasplakinolide is an artificial condition (choice B is wrong). The parasite does not adhere to blood vessel walls directly; it mediates the binding of the erythrocyte in which it is living to blood vessel walls, and again, a reduction of adhesion would not be an advantage (choice C is wrong).

33. **B** The passage states that actin is involved in transport of *var* genes, and actin is also known as a microfilament (choice B is correct). Microtubules are made of tubulin (choice A is wrong),
intermediate filaments are made of several different proteins, but not actin (choice C is wrong), and while sarcomere thin filaments do contain actin, they also contain other proteins (tropomyosin and troponin) and are only found in muscle cells (choice D is wrong).

34. A PfEMP1 is described in the passage as binding the erythrocytes to vessel walls. This could lead to a pile-up of erythrocytes and a blocked vessel (choice A is correct). The other symptoms listed are not related to the adhesion of erythrocytes to vessel walls (choices B, C, and D are wrong).

35. B The cerebral malaria-causing infected erythrocyte is described as binding to the walls of venules; the next vessels in the pathway would be veins (choice B is correct). The blood flows through arteries (choice D is wrong), then arterioles (choice A is wrong), then capillaries (choice C is wrong), then venules, then veins.

Passage VII (Items 36-39)

36. A If there are fewer visual pigment molecules to transduce light into signals (action potentials), then there will be fewer signals. Action potentials are an all-or-none event, there cannot be a “less intense” signal (choice B is wrong). Each signal is sent from a photoreceptor with a specific pigment, responding to a particular wavelength; other pigments, plentiful or not, cannot respond to the wavelengths of the weakly perceived color (choice C is wrong). Pigment molecule synthesis is not regulated by light molecules (choice D is wrong).

37. A Since only the red pigment is absent, green color perception should not be affected (choices B, C, and D can be eliminated and choice A is correct).

38. C The passage states that red/green colorblindness is an X-linked trait. (Note that since the son gets a Y chromosome from his father, the father’s genotype/phenotype is irrelevant in this instance.) Since the mother has normal vision, she must have at least G*R+ on one of her X chromosomes (choice B can be eliminated). Since her son inherited “colorblind with green pigment absent”, her other X chromosome (the one she passed on to her son) must have G- on it (choice D can be eliminated). And finally, since her son did NOT inherit “red pigment absent”, her other X must be G–R+ (choice A can be eliminated and choice C is correct).

39. D The photoreceptors in the retina (rods and cones) are the cells that produce visual pigments. The visual center of the brain and the optic nerve are not exposed to light, so would not express the visual pigment proteins (choices A and B can be eliminated). While the pigment cells of the iris do express pigment proteins, they are not the pigments involved in visual transduction (choice D is correct and choice C is wrong).

Passage VIII (Items 40-43)

40. A Nonshivering thermogenesis involves the electron transport chain, but instead of using the proton gradient to generate ATP, the protons are simply allowed to flow down their gradient, NOT through the ATP synthase, with the energy dissipated as heat. Mitochondria are the organelles in which the electron transport chain is found, and BAT has significantly more mitochondria than white adipose tissue (choice A is correct and choices B, C, and D are wrong).

41. B Item I is true: in the experiment, the sham operation was the control for the pinealectomy (choices C and D can be eliminated). Item II is false: the pinealectomy is the experimental group (choice A can be eliminated and choice B is correct). Item III is true and Item IV is false: the normal temperature was the control for the hot temperature.
42. **C** The tissue involved in thermogenesis is BAT, and in Table 1 there is no significant difference between BAT mass in the Sham group and in the Pinealectomy group (choices A and B can be eliminated). When trying to determine the significance of the pineal gland in thermogenesis, the Sham and Pinealectomy groups should be compared, not the Normal and Hot groups (choice C is correct and choice D is wrong).

43. **D** The experiment in the passage compares hamsters with pineal glands (Sham) to hamsters that have had their pineal glands removed (Pinealectomy, Px). In the question, the hamsters injected with extract (Pgex) are like the Sham group, and the hamsters injected with saline (Psal) are like the Px group. Think of it as groups that have more pineal activity (Sham and Pgex) vs. groups that have less pineal activity (Px and Psal). Table 1 shows that Sham/Hot have significantly lower pituitary weights that Px/Hot; if the pituitary weights of Pgex/Hot are less than those of Psal/Hot, this would validate the results of the first experiment (choice A can be eliminated). This experiment is not comparing groups at different temperatures, just groups with more or less pineal activity (choices B and C compare temperatures and are irrelevant). If the testes weights of Pgex/Hot are greater than those of Psal/Hot, this would be opposite to the results of the first experiment (testes weights of Sham/Hot are significantly less than those of Px/Hot) and would NOT validate the results (choice D is the correct answer choice).

**Freestanding Questions (Items 44-47)**

44. **C** Both individual tissue cells and Paramecium can reproduce by mitosis (choice A is wrong), possess organelles (choice B is wrong), and can run metabolic reactions (choice D is wrong). However, individual cells making up a tissue are no longer capable of independent life, as they rely heavily on other systems to supply them with nutrients and carry away waste (blood stream, respiratory system, etc., choice C is correct).

45. **D** In the absence of oxygen, muscle cells rely on lactic acid fermentation to produce ATP. In this process, glucose is first phosphorylated to glucose-6-P (choice B can be eliminated) and ultimately converted to pyruvic acid (choice A can be eliminated). However instead of being decarboxylated to acetyl-CoA, the pyruvic acid is reduced to lactic acid (choice C can be eliminated and choice D is correct).

46. **C** If the genome is 23% adenine, then it must also be 23% thymine, since A base-pairs with T. Therefore, G-C base pairs must make up the remaining 54% of the genome; 27% guanine and 27% cytosine.

47. **B** The structure of a typical fatty acid is depicted below:

![Fatty Acid Structure](image)

It consists of a long, non-polar organic tail and a carboxylic acid group at its head.

**Passage IX (Items 48-51)**

48. **C** Carbonic anhydrase works in the red blood cells to convert the substrates CO2 and H2O into their product carbonic acid (H2CO3). If the enzyme is inhibited, the substrates would build up (choices A and B are wrong); since the CO2 comes from the tissues, CO2 would accumulate there (choice C is correct). H2O would not accumulate as it is free to leave or enter cells osmotically (choice D is wrong).

49. **A** The passage states that the bicarbonate ion (HCO3−) resulting from the conversion of carbon dioxide and water into carbonic acid leaves red blood cells in exchange for the entry of Cl−. Since
veins typically have more CO₂, and thus more HCO₃⁻ it would logically follow that they would have more Cl⁻ as the HCO₃⁻ is exchanged (choice A is correct and choice C is wrong). Veins and arteries have the same number of RBCs (choices B and D are wrong).

50. A  According to Le Châtelier’s Principle, increased P_{CO₂} levels would push the reaction in Equation 1 to the right (choice B is wrong) and lower P_{CO₂} levels would push the reaction to the left (choice C is wrong). If the reaction is pushed to the right (increase P_{CO₂}), then levels of H⁺ ions would also increase, causing the pH to fall (become more acidic, choice A is correct and choice D is wrong).

51. C  If the RBCs must pass through the capillaries in single file, more of their surface area will be exposed to the diffusing gases, plus they will have to proceed a little more slowly and orderly. This will increase the rate of diffusion to more effectively move the gases in and out of the cell (choice C is correct). There is no reason to assume this would cause an increase in CO₂ production (choice A is wrong) and also no reason to assume that Hb would only be available to CO₂ and not O₂ (choice D is wrong). The RBCs never have direct contact with the alveoli; the alveolar walls and the capillary walls separate the alveoli from the RBCs (choice B is wrong).

Passage X (Items 52-56)

52. D  Transport of endocytosed material typically travels from the endosome to a lysosome, where the material is broken down. If the STx is able to move to the Golgi, it must be bypassing breakdown in the lysosome (choice D is correct and choices A, B, and C are wrong).

53. C  The passage describes subunit A as mostly α-helical. Proline, because of its unique ring structure, disrupts α helices, and these are a form of secondary structure (choice C is correct). It is subunit B that mediates retrograde traffic (choice A is wrong), and the loss of secondary structure is likely due to a loss of hydrogen bonding (choice B is wrong) which would lead to lower catalytic activity, not higher (choice D is wrong).

54. B  The issue with STx is that it disrupts protein synthesis (translation). If a great amount of it were released at once, due to, say, lysed cells, translation in the host cells may be significantly disrupted (choice B is correct). GPP130 is normal host protein; normal host proteins are not the targets of antibiotics (choice A is wrong). STx acts to disrupt protein synthesis, not to confer antibiotic resistance (choice C is wrong), and E. coli are bacteria, not viruses (choice D is wrong).

55. A  K_d is analogous to the Michaelis constant K_m, which indicates the affinity with which substrate binds to the active site of an enzyme; the lower the K_m, the higher the affinity. K_d is a measure of affinity of GPP130 for the toxin. Thus any effective inhibitory compound would have to bind the toxin with a higher affinity than GPP130 (choices C and D are wrong), and in fact the lowest K_d would represent the highest affinity (choice A is correct and choice B is wrong).

56. D  Subunit A is described in the passage as a protein that is activated by cleavage; the enzyme that would cleave a protein is called a protease (choice D is correct). Nucleases cleave nucleic acids such as DNA and RNA; the prefixes indicate where on the strand or what type of nucleotide is being acted on (choice A, B, and C are wrong).

Freestanding Questions (Items 57-59)

57. A  The only time lacZ is transcribed is when CAP is bound to the promoter, so CAP must be an activator (choices B and D can be eliminated). However if both CAP and LacI are bound, there is no lacZ transcription, indicating that LacI must be a repressor (choice C can be eliminated and choice A is correct).
58. **B**  “Entropic penalty” refers to the loss of disorder when water molecules must arrange themselves in an orderly manner around a hydrophobic group. Substituting leucine (a nonpolar amino acid) for threonine (a polar amino acid) at the surface of a protein reduces this entropic penalty as the hydrophobic leucine would be gone and the water molecules would be less orderly (choice B is correct). Substituting isoleucine (nonpolar) for aspartic acid (polar) at a buried site would not lead to as big a drop, as the interiors of proteins are typically hydrophobic and there isn’t as much water; water molecules are typically found near the surface as proteins usually exist in aqueous environments (choice A is wrong). Glycine and proline are both hydrophobic, and arginine and tyrosine are both polar; substituting one for the other (regardless of location) would likely not change the entropic penalty (choices C and D are wrong).

59. **A**  The mouth is derived from an invagination of ectoderm; it is essentially skin (choice A is not derived from endoderm and is the correct answer). The other structures are all derived from endoderm; as are most of the epithelial tissues inside the body (choices B, C, and D are wrong).
PSYCHOLOGICAL, SOCIAL, AND BIOLOGICAL FOUNDATIONS OF BEHAVIOR SOLUTIONS

Passage I (Items 1-5)

1. C As indicated in the symbol key, the dark bars in the graph shown in Figure 1 represent the number of words recalled from the list. As the age of the groups increases, the dark bars become increasingly shorter, which means that the number of words recalled is decreasing. This pattern indicates that recall ability declines with increased age (choice A is true and can therefore be eliminated). The gray bars in Figure 1 represent the number of words recognized, which fluctuates only slightly across the three age groups of non-Alzheimer’s participants. This suggests that recognition remains relatively stable across the lifespan (choice B is true and can therefore be eliminated). The number of words recognized by participants without memory impairment ranges from approximately 16 to 18, depending on the age group. In contrast, the Alzheimer’s group recognized only four words. This clearly suggests that participants without memory impairment perform better on a recognition task than those with memory impairment (choice D is true and can therefore be eliminated). Once one has identified the pattern of declining recall ability as a function of age, it may appear that the Alzheimer’s group represents the equivalent of the oldest group in the study, since this group is positioned after the other three groups and recall ability is the lowest of all the groups. However, this interpretation is not supported. One can only conclude that Alzheimer’s participants exhibit the weakest recall ability, but one cannot conclude that this is due to accelerated aging. In fact, Alzheimer’s is not a disease of accelerated aging; rather, it is a disease of brain deterioration, or atrophy, which is the true cause of the decline in recall ability (choice C is not supported and is therefore correct).

2. A The spreading activation model of memory holds that long-term memory is organized into a network of interconnected words or concepts. For example, the word yellow may be associated with the words blue (because both words are types of colors), banana (because a banana is yellow), and yoyo (because both words begin with “y”). Any given word would likely be associated with multiple words on the basis of various conceptual or phonetic relationships, and each of these other words is, in turn, associated with many other words. Thus, the word “yellow” may ultimately trigger recall of the word “basketball” or the image of a basketball, because “yellow” may be associated with the word “blue”, and “blue” and “basketball” both begin with the letter “b”. Accordingly, the finding in the last paragraph of the passage that non-impaired participants recalled words that were related to those on the list reflects the spreading activation model of memory (choice A is correct). Craik and Lockart’s depth of processing theory maintains that information can be processed at various levels of intensity, or depth, and that information processed more deeply is better embedded in long-term memory. For instance, thinking critically about a newspaper article will lead to better long-term retention of the material than simply reading the article. This model does not propose that one will recall related words or concepts (choice B is wrong). The serial position effect is the tendency to recall items from the beginning and end of a list while forgetting those items from the middle of the list. It does not predict recall of associated words or concepts (choice C is wrong). The visuospatial sketchpad is Baddley’s cognitive structure of visually-based working memory, and it does not lead one to recall semantically-related words on a recall task (choice D is wrong).

3. B The recency effect is the tendency to recall items most recently heard or read, which, by definition, is the end of the list. As indicated by the solid dark line in Figure 2, the Alzheimer’s group recalled many items from the end of the list but none from the middle or beginning. The other groups recalled comparatively fewer items from the end of the list. Thus, the Alzheimer’s participants exhibited the recency effect (choice B is correct). The primacy effect is the tendency to recall items from the beginning of the list but not subsequent items. The non-impaired groups recalled items from both the beginning and end of the list, which demonstrates both primacy as well as recency effects. In contrast, the Alzheimer’s group did not recall any items from the beginning of the list (choice A is wrong). Interference refers to the process by which sensory
processing of information other than the target information disrupts the memory process. Although the Alzheimer’s participants’ inability to recall words from the beginning or middle of the list may be interpreted as a function of the interference caused by the words at the middle or end of the list, other interpretations are possible, too. Specifically, the inability to recall words from earlier in the list may simply be a function of the passage of time rather than actual interference (choice C is wrong). The continuity effect is not a term associated with memory processes (choice D is wrong).

4. D The graph in Figure 2 illustrates that the non-impaired groups exhibited both primacy and recency effects, as they recalled words from the beginning and end of the list better than those from the middle. This finding implies that the recency effect is a function of short term memory, while the primacy effect is a function of long term memory. If so, short term memory and long term memory are discrete systems (choice D is correct). If the two systems are not discrete, but rather short term memory is the activated component of long term memory, then, by definition, the two systems fall along a continuum. If this were true, words from the middle of the list would be recalled at least as well as those from the beginning of the list. From the data in Figure 2, this was clearly not the case (choice B is wrong). Although the primacy and recency effects suggest that a similar number of items are recalled from each of the two memory systems, this does not mean that the two systems function similarly or are uniform. It is possible that the underlying mechanisms of each system are quite different but that one is able to recall comparable amounts of information from each (choice C is wrong). Sensory memory is the initial brief stage of memory that transfers sensory experience to the second stage of memory known as short term memory. While information is in short term memory, one has ability to rehearse or otherwise maintain the information so that it can be transferred to the third stage of memory, long term memory. Thus, in a sequential process, short term memory follows sensory memory and is not the active part of sensory memory (choice A is wrong).

5. C Proactive interference is the process by which information already in long term memory precludes encoding or retrieval of information in short term memory. The graph in Figure 2 suggests that those with Alzheimer’s lack the ability to store and/or retrieve information in long term memory; therefore, proactive interference would not be expected to occur (choice C is correct; choice A is wrong). It is true that short term memory is disrupted by proactive interference, but it does not logically follow that those with a functional short term memory must, by definition, be subject to proactive interference. In fact, as noted above, proactive interference is a function of an intact long term memory store (choice B is wrong). While it is true that long term memory is associated primarily with the medial temporal lobe, Alzheimer’s disease may not necessarily affect the temporal lobe but can affect other lobes of the brain, such as the frontal lobe (choice D is wrong).

Passage II (Items 6-9)

6. C Social reproduction describes the perpetuation of social inequalities across generations that is facilitated by institutions like government or education. Both Bill and Alice both overcome significant challenges to become successful professionals; thus, their stories contradict social reproduction theory. This concept is least applicable to Alice and Bill’s experiences (choice C is correct). Meritocracy is a concept that describes a social system where effort and talent are rewarded. The stories of Alice and Bill show meritocracy in action, as they experienced social rewards for their hard work (choice A is wrong). Intergenerational mobility describes a change in social status between parents and children. Intergenerational mobility can be upward or downward; Alice and Bill both experienced upward mobility (choice B is wrong). Relative poverty is the inability to meet the average standard of living within a society. Alice and Bill both experienced relative poverty as children (choice D is wrong).

7. C The Followers are a comparison group that allows the researchers to test their hypothesis about what affects pathways to success (choice C is correct). Adding the Followers as a control group does not add any additional variables to the study (choice A is wrong). While adding more individuals to the study does increase its overall sample size, this is not the reason why Followers
were included (choice B is wrong). Similar to choice A, adding the followers does not change the operationalization of the dependent variable (choice D is wrong). The dependent variable remains the same; adding the comparison group helps the researchers to isolate the effect of socioeconomic background on locus of control.

8. D The researchers confirmed their hypothesis that individuals from disadvantaged socioeconomic backgrounds had a stronger internal locus of control, meaning that the individuals feel that their life circumstances are tied closely to their personal traits. For this reason, a person like Alice is most likely to say something resembling choice D (choice D is correct). Having an external locus of control, in contrast, makes a person more likely to attribute their circumstances to factors outside of their control. Choices A, B and C are consistent with an external locus of control (choice A is wrong, choice B is wrong, choice C is wrong).

9. B The study is designed to investigate how socioeconomic background affects an individual’s locus of control. The researchers used snowball sampling to compose their study sample of Pathmakers and Followers, and this could lead to a sampling bias because all participants come from the same social network (choice B is correct). Choice A is not a good answer because, while gender and age are central organizing concepts in sociology, they are not crucial to the study design (choice A is wrong). While conducting many interviews can lead to researcher fatigue, this is not a weakness in the design of the study itself (choice C is wrong). Choice D assumes that the researchers will analyze the data quantitatively, but the method noted in the passage—in depth interviewing—generally implies qualitative analysis (choice D is wrong).

Passage III (Items 10-13)

10. D The passage states that the possible outcomes of child maltreatment include heart and liver disease, anxiety, depression, alcohol and drug abuse, unintended pregnancy, and unemployment. None of these conditions qualifies as a personality disorder (choice D is correct). Heart and liver disease are chronic diseases (choice A is wrong). Anxiety and depression are mood disorders (choice B is wrong). Alcohol and drug use, unemployment, and unintended pregnancy can all be related to chronic stress or mood disorders (choice C is wrong).

11. C One finding noted in the passage is that incidence rates for child maltreatment cut across demographic groups. This contradicts the common perception that child maltreatment is subject to social stratification (choice C is correct). Social stratification is a concept that describes how a class-based hierarchy in society can result in people from different positions in the hierarchy having different life experiences. Coming from a lower class position can mean greater exposure to social problems such as crime or poverty, but child maltreatment, as shown in the passage, does not follow this pattern. Social reproduction refers to the perpetuation of inequality across generations. It is not related to the phenomenon described in the passage (choice A is wrong). Likewise, institutional discrimination, unequal treatment that is a feature of social institutions, is also not related to the phenomenon described in the passage (choice B is wrong). Cultural relativism is the evaluation of a culture based on that culture’s own standards; this concept is not related to the passage (choice D is wrong).

12. A Confirmation bias is the tendency to favor information that confirms existing beliefs, and can take place both in the search for and interpretation of evidence. In this scenario, the physician would be susceptible to confirmation bias because he or she may be looking specifically for evidence of child maltreatment as part of good patient care protocols. It is irrelevant to the question of confirmation bias that parents may conceal evidence of child abuse from physicians because the risk of confirmation bias lies in the physician’s cognitive processing of the situation (choice A is correct). Choices B, C, and D refer to aspects of cognitive processing that the physician does during the course of the medical encounter. Because confirmation bias is the tendency to favor information that confirms existing beliefs, a physician who is attentive to evidence of child abuse may find confirmatory evidence of child abuse (choice B is wrong). Choice C is similar to choice B, in that evidence of child maltreatment can be ambiguous, leading physicians to be more
susceptible to finding evidence that confirms their existing beliefs (choice C is wrong).
Confirmation bias may be stronger for emotionally charged topics; child maltreatment is an emotionally charged topic (choice D is wrong).

13. A An organization is a group that comes together to pursue activities jointly, efficiently and in an organized fashion with a division of labor and distinct roles. Choice A is correct because it is the only choice that names an organizational change, adding a pediatric subspecialty to the existing organizational structure of pediatrics within the medical profession. Choice B describes how researchers turn their attention towards current concerns and social problems (choice B is wrong). Choice C describes legal changes in the governance of child abuse reporting (choice C is wrong). Choice D describes the public discourse surrounding child abuse and how child abuse is to be understood in United States culture (choice D is wrong).

Freestanding Questions (Items 14-16)
14. B This question addresses the social psychology construct of group polarization, which is the tendency of people to become more extreme in their views when discussing those views with others that share a similar perspective. Thus, since each of the four students is opposed to the ban, conversing with one another about the ban will likely result in each student developing even stronger opposition (choice B is correct; choices A, C, and D are wrong).

15. B Conflict theorists, such as Karl Marx, emphasize power relations, differential ownership of capital, and social status as driving social forces (choice B is correct). While norms and rituals impact patients’ relationships with their doctors, norms and rituals are not aspects of conflict theory (choice A is wrong). Likewise, aggression and attachment, which are social psychological concepts that describe behavioral relations between individuals, are not part of conflict theory (choice C is wrong). Conformity and assimilation are also not related to conflict theory (choice D is wrong).

16. B Anomie is a condition where an individual is not governed by firm social norms or values and thus experiences a sense of being normless. When individuals experience anomie, this can indicate a disintegration of the bonds between individuals and their social communities that leads to lower social cohesion (choice B is correct). Choices A and C describe elements of groupthink, where social dynamics within in groups promote similar thinking among members (choice A is wrong, choice C is wrong). Likewise, choice D is also related to concepts of social control. Choice D describes a situation that is the opposite of anomie (choice D is wrong).

Passage IV (Items 17-20)
17. B This question requires strategic thinking about which answer choice is the best choice. The first paragraph states that those with AS possess cognitive and language abilities but lack certain social abilities. This implies that there is not a singular intelligence but rather a set of multiple intelligences. The best answer choice is one that most clearly asserts the existence of multiple intelligences. Galton’s theory emphasizes that people vary in their intellectual potential, and Binet sought to establish classifications for varying levels of intelligence. While either of these theories may be compatible with the notion of multiple types of intelligence, they are equally compatible with the singular theory of intelligence as well (choices C and D are wrong). In contrast, Gardener’s theory of eight intelligence explicitly espouses the notion of multiple intelligences and therefore represents the best answer choice (choice B is correct). Spearman’s theory of general intelligence seems, by definition, incompatible with the observation that those with AS possess average mental ability in one area but lack ability in another (choice A is wrong).

18. C Observational learning refers to the process by which individuals learn behavior by watching the behavior of others and its consequences. According to the passage, mirror neurons are activated when people observe others, so, by definition, they are involved in observational learning (choice
C is correct). Operant conditioning refers to learning that is driven by reward and punishment, while classical conditioning refers to learning driven by the association of one stimulus with another. Neither of these pertain directly to watching others (choices A and B are wrong). Latent learning refers to learning that is internalized but not immediately expressed through behavior (choice D is wrong).

19. D If AS has a genetic basis, then, by definition, there are biological components at the gene level that contribute to the syndrome regardless of the environment in which a person lives. One way of assessing the genetic basis of a given disorder is to study relatives of those with the disorder. Theoretically, a finding that relatives of those with AS also exhibit AS or characteristics of AS would indicate that AS has a genetic basis (choice B is wrong). However, if the relatives shared the same home or environment as those with AS, it is impossible to conclude that common characteristics are due to genetic links rather than environmental influences. Environmental causes can only be ruled out if common traits are found in relatives that did not share a similar environment. It can be assumed that the siblings described in the study likely shared the same environment as those with AS, since the passage does not specify otherwise. If so, the shared environment limits the confidence with which one can conclude that AS has a genetic basis (choice D is correct). All participants in the study shared the same percentage of genes with those with AS, because all were siblings of individuals with AS (choice A is wrong). If some did not share the same mother or father, one could expect the study to state this explicitly. The study states that the two study groups were matched for sex and age, so differences in genetic links between same-sex or opposite-sex siblings should not be statistically significant (choice C is wrong).

20. C An extrinsic motivator is a reward for a desired behavior. Thus, play time is considered an extrinsic motivator because it rewards the desired behavior of correctly naming an emotional expression, which indicates improved emotional processing (choice C is correct). Playing music during a task or using emotionally expressive faces in a task may reward or facilitate participation in the overall task, but these techniques do not reward specific behaviors that reflect improved emotional processing (choice A and B are wrong). It is not clear how rewards are structured in the memory game, so Choice D is not the best response (choice D is wrong).

Passage V (Items 21-25)
21. B Kohlberg described three levels of moral development each of which is comprised of two stages. Pre-conventional morality is associated with early school-age children and is comprised of Stages I and II. Stage I is morality based on rewards and consequences, while Stage II is morality based on benefit or harm to one’s self or family. Conventional morality is associated with adolescents and is comprised of Stages III and IV. Stage III is morality based on approval or disapproval of authorities, while Stage IV is morality based on concrete rules. Post-conventional morality is associated with post-adolescence and is comprised of Stages V and VI. Stage V is morality based on an understanding of social contracts, while Stage VI is morality based on universal ethics. The ages of the children in the study range from five to nine, which corresponds to Kohlberg’s level of pre-conventional morality. Placing the television characters in prison as a consequence of their behavior is an example of reward or punishment associated with Stage I morality (choice B is correct). Portrayal of the negative impact of violence on the victim reflects Stages V or VI and would be expected to resonate with individuals in post-adolescence (choice C is wrong). Lengthening the length of the video, breaks from activity, and short-term interactive play are irrelevant to Kohlberg’s theory of moral development (choice A and D are wrong).

22. B The independent variable in Study 1 is exposure to violent media. In order to test the frustration hypothesis, however, the researchers would need to induce frustration and then observe whether or not the children exhibit aggression. Therefore, inducing frustration would replace exposure to violent media. It is reasonable that prohibiting the children from using a desirable toy would induce frustration (choice B is correct). If exposure to violent media is not replaced by the inducement of frustration, it is impossible to use measures of frustration or physiological arousal
as an indication that frustration causes aggressive behavior. Rather, one could argue that exposure to violent media causes both aggression and increased frustration (choices C and D are wrong). Informing the participants of the sex of the child they are helping or hurting would be associated with a hypothesis about in-group and out-group bias, not with a hypothesis about frustration (choice A is wrong).

23. A The James-Lange theory of emotions maintains that physiological arousal precedes one’s experience of “emotion” (choice A is correct). The view that emotions are experiences simultaneously with physiological arousal is espoused in what is known as the Canon-Bard theory (choice B is wrong). Using situational circumstance to cognitively interpret and label arousal is the central tenet of Schachter and Singer’s Two-Factor theory (choice C is wrong). Physiological arousal leading to fight or flight responses per se is not typically associated with the James-Lange theory (choice D is wrong).

24. C The process of imparting values or norms is known as socialization (choice C is correct). In a social context, assimilation refers to adopting the norms of a new host culture in place of those of one’s original culture (choice A is wrong). Discrimination is the process by which individuals are denied access to various resources or opportunities by virtue of their membership in a certain group (choice B is wrong). Stratification refers to social divisions within a society on the basis of qualities such as economic power, gender, or education (choice D is wrong).

25. C Piaget described four general stages of cognitive development, and each stage is reflected in specific cognitive achievements. The sensorimotor stage begins at birth and lasts to approximately 18 months of age. The stage of preoperational thought begins as a child learns a language and lasts until approximately five or six years of age. The stage of concrete operational thought begins around age six or seven and lasts until about 11 or 12. Formal operational thought is characterized by abstract thought. It begins around age 12 and lasts throughout adulthood. Recognizing that an object exists despite the fact that it is concealed from view is known as object permanence and is typically achieved during the sensorimotor stage. Thus, the two age groups in the study would not differ regarding this cognitive milestone (choice A is wrong). Accommodation is Piaget’s term for the modification of one’s internal schemas, or mental frameworks, to adjust for newly acquired knowledge. This process occurs throughout every stage of development (choice B is wrong). Reasoning about an alternative ending to a story is an example of the abstract thinking that is characteristic of formal operational thought. Neither age group would be expected to perform this task because both age groups are younger than the age associated with this cognitive stage (choice D is wrong). The understanding that volume does not change despite changes in shape or form is a milestone associated with concrete operational thought, which would be associated with the eight- and nine-year olds but not with the five- and six-year olds (choice C is correct).

Freestanding Questions (Items 26-29)

26. C This question draws on knowledge of World Systems Theory, which is a theory of global inequalities. This framework describes countries in terms of their relations to each other and ranks countries as core, semi-periphery or periphery nations according to the development of their economy and strength of their government. Core nations have strong governments and developed economies, while periphery nations are less economically developed and have weaker governments. In this question, Country A is a periphery nation (choice C is correct). Country B is a core nation (choice A is wrong). Neither Country A nor Country B are semi-periphery nations (choice B is wrong). The term “developed nation” is not a formal term within World Systems Theory (choice D is wrong).

27. C Psychology research has produced evidence that facial expressions are universally recognized. Since the question stem asks which behavior would be influenced differentially by culture, any answer choice that refers to a facial expression would NOT be correct (choices A, B, and D are
wrong). Gestures and postures are not facial expressions, so they would represent the best answer choice (choice C is correct).

28. B The research study described in the question stem required participants in different age groups to indicate how frequently they engaged in altruistic behaviors. Thus, the quality of altruism is operationalized as the responses of the participants to the question of how frequently they engage in altruistic behaviors (choice D is supported by the research design and therefore wrong). Even if the two age groups differed in their reports of frequency of such behaviors, researchers could not infer that age directly causes these differences. Firstly, age may influence how the participants respond to the question (choice A is supported and therefore wrong), and responses may not be wholly accurate. Secondly, age could influence mediating variables, such as physical health, means of transportation, or free time that may, in turn, influence the frequency with which one engages in altruistic behaviors. Thirdly, variables other than age, like gender or socioeconomic status, may influence altruistic behavior. The study does not indicate that researchers controlled for such variables (choice C is supported and therefore wrong; choice B is NOT supported and therefore correct).

29. C The “I” and the “me” are both terms from Mead’s theory of social behaviorism. The “I” is a person’s subject, while the “me” describes how a person perceives him/herself in the eyes of others (i.e. as an object). The “I” responds to the “me,” but is also the autonomous subject (choice C is correct, choice D is wrong). The id and the ego are terms from Sigmund Freud’s theory of personality, not from Mead (choice A is wrong, choice B is wrong).

Passage VI (Items 30-34)

30. B The symptoms experienced by Jay can be conceptualized from the perspective of classical learning theory. In this theory, a response naturally elicited by stimulus A will also be elicited by stimulus B if stimulus B becomes associated with stimulus A. The stimulus that naturally produces a given response is called the unconditioned stimulus, and the natural response is called the unconditioned response. If a neutral stimulus is presented together with the unconditioned stimulus, it is called a conditioned stimulus, and the subject will exhibit the same response as elicited by the unconditioned stimulus. The response to the conditioned stimulus is termed the conditioned response. In summary, an unconditioned stimulus yields an unconditioned response, and the associated conditioned stimulus yields a conditioned response. The number of trials necessary to condition a stimulus varies by the stimuli and circumstances. In the case described in the passage, the chaos and trampling at the moment of the train’s malfunction is considered the unconditioned stimulus, and Jay’s emotional response to this commotion is considered the unconditioned response. The setting of a confined train car is the conditioned stimulus, which has been conditioned in a single trail due to the intensity of the emotional response. Thus, Jay’s panic in any train car would be considered a conditioned response. However, Jay experiences panic in all confined spaces, which indicates that he has generalized the conditioned stimulus to all confined spaces. This is known as stimulus generalization (choice B is correct). Stimulus discrimination represents the opposite concept, whereby the subject distinguishes between the “true” conditioned stimulus and one that is similar but not exactly the same (choice A is wrong). Second-order conditioning occurs when a conditioned stimulus is paired with a neutral stimulus such that the neutral stimulus becomes conditioned as well (choice C is wrong). When a conditioned stimulus is repeatedly presented without the unconditioned stimulus, the conditioned stimulus loses its ability to elicit the conditioned response. This process is known as extinction. However, if the previously conditioned stimulus is later paired again with the unconditioned stimulus, it tends to be unnecessary to perform multiple trials in order to achieve the same level of association and conditioning as before. Rather, subjects tend to immediately associate the two stimuli to the same degree as they did prior to extinction. This tendency is known as spontaneous recovery, and it is irrelevant to the scenario described in the passage (choice D is wrong).
31. C As noted in the solution to Item 30, the stimulus that naturally produces a given response is called the unconditioned stimulus, and the natural response is called the unconditioned response. Thus, emotional arousal during the commotion of the train’s malfunction would be considered the unconditioned response (choice C is correct). Both intense panic in an elevator and physiological arousal in confined spaces represent generalized conditioned responses (choices A and B are wrong). Memory of an event would be best conceptualized as a conditioned response that is produced by the conditioned stimulus of physiological arousal (choice D is wrong).

32. D In statistical interpretation, a positive correlation occurs when an increase or decrease in one variable is associated with a corresponding increase or decrease in a second variable, respectively. In this sense, the word “positive” means “same direction”, because the two variables move in the same direction. However, when an increase in one variable corresponds to a decrease in the other variable, this trend is known as a negative correlation. In this sense, the word “negative” means “opposite direction”. As stated in the last paragraph of the passage, the researchers hypothesized that participants would be more confident in their memories of intensely negative emotional events than in their memories of intensely positive emotional events. They did not predict a relationship between the number of events recalled and the degree of confidence (choice A and C are wrong). In the same paragraph, the passage explains that negative emotionality was indicated by negative scores on the emotion scale, which means that lower scores correspond to more intensely negative emotion. If so, the researchers would expect that higher scores on the confidence scale would correspond with lower scores on the emotion scale. In other words, researchers hypothesized a negative correlation such that as scores on the confidence variable increase, scores on the emotion variable decrease (choice D is correct; choice A is wrong).

33. D Jay’s intense fear reaction would be viewed as a function of the fight-or-flight response that occurs when an organism perceives imminent threat. The sympathetic nervous system is responsible for facilitating large expenditures of energy such as those associated with the fight-or-flight response (choice D is correct), while the parasympathetic nervous system is responsible for conserving energy and resetting the body’s systems following a fight-or-flight reaction (choice A is wrong). The central nervous system is comprised of the brain and spinal cord, and, while its components are involved in the reaction to threat, it is a less specific system than the sympathetic nervous system and therefore does not represent the best answer (choice B is wrong). The somatic nervous system is associated with the peripheral nervous system, which transmits signals to and from the nerves of the body’s sensory organs. It is not implicated directly in the fight-or-flight response (choice C is wrong).

34. D Cortisol is a hormone associated with stress management, which is directly related to Jay’s conditioned response of fear in confined spaces (choice D is correct). Oxytocin is involved in muscle contraction (choice A is wrong), and Melatonin is involved in sleep regulation (choice B is wrong). Leptin is implicated in metabolic processes and storage of fat (choice C is wrong).

Passage VII (Items 35-38)
35. D Operant conditioning described a type of behavior modification therapy in which desired behavior is rewarded. The reward is thought to increase the expression of the desired behavior. In the study the high anxiety children are rewarded during week 2 for using their learned coping strategies to moderate anxious feelings (choice D is correct). Extinction and spontaneous recovery are terms related to classical conditioning (choice A is wrong, choice B is wrong). Classical conditioning is a form of conditioning in which two stimuli are paired. The classic example is Pavlov’s dogs, in which dogs were taught to express an intrinsic food response (salivating) upon hearing a bell ring. This conditioning is the result of pairing the food stimulus with the bell stimulus until the bell stimulus evoked the same response as the food stimulus (choice C is wrong).
36. A All four answer choices describe possible reward schedules for behavior reinforcement. Ratio schedules are based on the number of instances of the desired behavior, while interval schedules are based on time. In Week 3, the children are rewarded randomly for using their learned coping mechanisms. This is consistent with a variable-ratio reward schedule (choice A is correct). A common variable-ratio reward schedule is gambling, and these types of reward schedules tend to produce high rates of engaging in the desired behavior, even though the reward is random. A fixed-ratio schedule would provide a reward after a set number of expressions of the desired behavior (choice B is wrong). Variable interval schedules provide reinforcement after an unpredictable and inconsistent amount of time. Reinforcement is not tied to instances of the desired behavior, but rather time engaging in the behavior (choice C is wrong). These types of schedules thus tend to produce a “slow and steady” response. Fixed-interval reward schedules provide rewards on a consistent and predictable basis. They tend to produce the highest response right before the reward (choice D is wrong).

37. D Based on the results shown in Figure 1, parental anxiety predicts childhood anxiety. However, it is impossible to rule out the role of anxiety as a learned response within the existing study design (choice D is correct). That is, it is unclear what the role of genetics is in anxious behavior traits because the children were also raised by their anxious parents and could have learned to be anxious (choice A is wrong). In order to adjudicate the role of genes in anxiety, researchers would need to conduct studies of adopted vs. biological children. The researchers did not control for parental history of anxiety (choice B is wrong). Parental criticism may be one aspect of anxious behavior, but there could be other instances of parental criticism that are not related to anxiety (choice C is wrong).

38. B During Week 1 the researchers did not reward the use of coping mechanisms. During Week 2, researchers used a fixed-ratio schedule, which is shown to have a high response. During Week 3, the researchers used a variable-ratio schedule. This schedule also produces high responses and the children likely responded to the schedule in the same way that gamblers would respond to the chances of hitting the jackpot. Thus, the children’s frequency of engagement should increase over the course of the study (choice B is correct, choice A is wrong, choice C is wrong, choice D is wrong).

Passage VIII (Items 39-43)

39. D Memory systems have different components. The type of memory that is active when someone is using or learning new information is called working memory (choice D is correct). Working memory is engaged when perceiving aural or visual information. In Study 2, the participants hear a target word and have to keep it in their working memory. Hearing a target word engages the phonological loop of working memory. Implicit and procedural memory both refer to tacit knowledge of how to do things or conditioned associations about things (choice A is wrong, choice B is wrong). Sensory memory is a snapshot of the sensory aspects of the experience (choice C is wrong).

40. D This question relies on knowledge of the effects of the parasympathetic and sympathetic nervous system on physiology. The skin conductivity tests from Study 2 indicate that participants in the self-doubt condition have higher skin conductance and cortisol. These findings indicate that the sympathetic nervous system is activated (choice A is wrong). When the sympathetic NS is activated, gut peristalsis is inhibited (choice D is correct). Increased blood sugar and increased pupil dilation are both expected effects of sympathetic NS activation (choice B is wrong, choice C is wrong).

41. C Stereotype threat, in this case the activation of the stereotype that women are worse at math than men, was activated in the math assessment group (choice C is correct). The instructions for this condition included telling the men and women assigned to this condition that the function of the math test was specifically to test sex differences in math ability. The women in the problem solving group performed better on average than the men, meaning that the stereotype that
women are bad at math was not activated in this group (choice A is wrong). The men in the teaching intervention group outperformed the women, but men are not subject to stereotype threat in this scenario, since men are presumed (also stereotypically) to be better at math (choice B is wrong). The women in the teaching intervention group fared better than the women in the math assessment group, which indicates that the teaching intervention helped ameliorate stereotype threat for the women. Men’s performance dropped slightly, but this cannot be attributed to stereotype threat because men are not subject to the stereotype of being bad at math (choice D is wrong).

42. D Study two showed that women’s performance on a math assessment suffered if the stereotype that women are bad at math was activated before they took the test. In the two other conditions, where the stereotype was not activated (problem solving group) or where it was activated but the women were made aware of it (teaching intervention group), women fared much better (choice D is correct). Although the results from Study 2 show that anxiety can interfere with working memory, these results cannot be immediately extrapolated to explain stereotype threat in Study 1. This also means, however, that anxiety cannot be ruled out as an explanatory factor in the results of Study 1 (choice A is wrong). Stereotype threat is not caused by sympathetic NS arousal, but rather is the result of social interactions and self-concept (choice B is wrong). Although the teaching intervention group suggests that making people aware of stereotype threat can lessen the impact of the threat on performance, it does not follow that stereotype threat is not due to self-fulfilling prophecy (choice D is wrong).

43. D Women in the teaching assessment group showed better scores than women in the math assessment group, but worse scores than women in the problem solving group. Likewise, while men performed on average better in the teaching assessment group than the problem solving group, both groups received a lower average score than the math assessment group. The teaching intervention did not produce a clear improvement on men’s and women’s performance, so this conclusion is not supported by Figure 1 (choice D is correct). Participants in the problem solving and teaching assessment conditions had average scores in the 50th percentile; these groups are comparable (choice A is wrong). Women in the teaching intervention group did not outperform women in the problem solving group (choice B is wrong). Across the three groups, men and women only differed significantly in the math assessment group (choice C is wrong).

Freestanding Questions (Items 44-47)

44. B The gestalt school of psychology posited many tendencies of visual perception that reflect a predisposition to organize visual details in a holistic manner. The gestalt law of proximity holds that objects positioned closely together will be perceived as a unit, which underlies the perception of six XO pairs rather than 12 individual letters (choice B is correct). Similarity refers to the grouping of similar objects together (choice A is wrong), while continuity is the tendency to perceive a pattern as persisting beyond its physical end (choice C is wrong). Common fate is the tendency to perceive objects oriented in the same direction as a group (choice D is wrong).

45. A Social psychologists have noted what is called the bystander effect, which is the tendency of people to refrain from helping another individual if other people are present. A theoretical explanation for this is that each bystander assumes that others will provide help. Thus, the student described in the question stem would be most likely to receive help if there are fewer people present at the time of the fall (choice A is correct; choice B is wrong). Helping behaviors have not been correlated with particular times of the day or urban versus suburban neighborhoods (choices C and D are wrong).

46. B Meritocracy is reward based on individual effort and talent. In other words, rewards (merit) are based on an individual’s achievements. This is best explained by choice B, in which selections are made based on achieved status rather than ascribed status (choice B is correct). Master status describes one personal trait that comes to dominate over a person’s other traits. Master status as a concept cannot explain the social dynamics of status attribution and achievement.
Social status, in this question, does not have a specific meaning in this question—although social status refers to prestige, there is no information about how that status was attained. Meritocratic selections are not made based upon ascribed status; ascribed status is an assumption about someone's effort or talent, which is exactly the opposite of meritocracy (choice C is wrong, choice D is wrong).

47. D Social integration in the U.S. is the best answer for this question because immigrant groups that do not assimilate into wider U.S. culture but rather live in ethnic enclaves may experience health benefits (choice D is correct). Social segregation, choice A, is similar, and can cause detrimental effects on health. However, in this scenario, the immigrant members of the ethnic minority group would probably experience discrimination that is similar to the native-born members of the ethnic group (choice A is wrong). Length of residence in the U.S. may explain some initial differences in health between immigrant and native-born ethnic minorities, but if the immigrant group lives in an ethnic enclave, the differences are unlikely to fade in subsequent generations. This would point away from length of stay as a factor related to the effect of discrimination on health (choice B is wrong). The question stem does not mention geographic differences in health outcomes for ethnic minority groups, so there is not enough information to evaluate this as a correct answer (choice C wrong).

Passage IX (Items 48-51)
48. A Images on the left side of the visual field of each eye are processed on the right side of the brain. Language is processed primarily on the left side of the brain. The corpus callosum is responsible for neuronal communication between the two sides of the brain. In split-brain patients, however, the corpus callosum is severed. Therefore, in split-brain patients, images processed on the right side of the brain cannot be further processed for language associations, and it would be impossible to link colors with their respective names. If so, the procedure described in the question stem would allow researchers to determine if CP occurs in the absence of access to color names (choice A is correct). Split-brain patients would still be able to perceive the colors on either side of the visual field (choice C is wrong). The corpus callosum does not play a role in the actual processing of color (choice B is wrong), nor does the frontal lobe play a role in the recognition of color (choice D is wrong).

49. A The retina of the eye contains two types of receptors, including rods and cones. Rods are responsible for the basic detection of stimuli in low-light conditions, while cones detect color and fine nuances of well-illuminated stimuli. Study 1 involves distinction between colors, so rods would play a less significant role in this process than cones. Thus, a deficit in rods would cause less interference than a deficit in cones (choice A is correct; choice B is wrong). The part of the retina in which the cones are concentrated is called the fovea, so a lesion in the fovea would interfere significantly with the task (choice D is wrong). The occipital cortex is the part of the brain responsible for the completion of all visual processing, so a lesion in this cortex would significantly interfere with the task in Study 1 (choice C is wrong).

50. A The linguistic determinism hypothesis, also known as the Sapir-Whorf hypothesis, holds that people's thinking is significantly influenced by their native language. Therefore, despite receiving training on the blue-green distinction, Berinmo speakers, whose native language does not account for a distinction between green and blue, would not be able to distinguish between these two color categories as well as native English speakers. They would, however, be able to distinguish between yellow and green (nol-wor continuum) equally well, since their native language does acknowledge a distinction between those two colors (choice A is correct; choices B, C, and D are wrong).

51. A Study 1 involved the presentation of stimuli of different colors, or hues. Hue is determined by the frequency, or length, of the light wave (choice A is correct). Amplitude is the amount of energy in a light wave that results in a corresponding subjective sense of brightness (choices B and D are
Passage X (Items 52-55)

52. D Patient and hospital characteristics could have served as confounding variables in this study. In other words, if the researchers did not control for these factors, it would have been impossible to isolate the particular relationships between race and revascularization and gender and revascularization (choice D is correct). Discussions about controlling for study characteristics within research design are related to the issue of confounding variables. The other three answer choices are not related to confounding variables. Sample construction is not related to confounding variables (choice A is wrong). The researchers did not seek to establish a causal relationship between the variables; this study produced correlational results (choice B is wrong). The researchers only determined variations by gender and age; they were not investigating variations across the sample of hospitals or among the patients as individuals (choice C is wrong).

53. C The results of the study show that Black patients and White patients receive revascularization therapy at differential rates. To answer this question correctly requires distinguishing between discrimination and prejudice. Discrimination is unequal treatment, either on an individual or institutional level, while prejudice describes negative attitudes toward certain groups. Without data about the attitudes of the providers for the patients whose data were used in the study, the researchers cannot draw any conclusions about prejudice (choice A is wrong, choice B is wrong, choice D is wrong). This leaves choice C, which is correct. Although the researchers cannot draw conclusions about the role of provider prejudice in the differential treatment of Black and White patients, there are clear differences in the treatment of the two racial groups on a population level. This suggests institutional discrimination, unequal treatment of certain groups that has been codified or embedded into organizational structures or operating procedures.

54. C About 10% of the sample was excluded from the study because hospitals declined to participate in the study or the patient’s medical records were incomplete. This reduces the overall number of cases the researchers have to work with and could pose a methodological limitation (choice C is correct). Medical records are a common source of data for research on quality improvement and health disparities; choice A is not a limitation (choice A is wrong). The researchers did not need to conduct interviews in order to investigate the health disparities by gender and race in this study (choice B is wrong). The study included about 5,000 participants, which is a sufficient number for the study (choice D is wrong).

55. D The only concept given as an answer choice that describes cross-cultural relations is ethnocentrism (choice D is correct). Ethnocentrism is the tendency to evaluate other cultures using standards intrinsic to one’s own culture. Social reproduction describes the perpetuation of inequalities across generations. This may include inequalities such as health disparities, but this is not related to cultural bias (choice A is wrong). Stereotype threat is a concept from social psychology that describes how a person’s performance on a task may be affected by their perception of themselves as good at the task in question (choice B is wrong). This term is unrelated to the passage. Social mobility describes status change within families across generations (choice C is wrong). This term is unrelated to the passage.

Freestanding Questions (Items 56-59)

56. B Having social capital means that one can draw on social networks for gain, such as jumping the queue at the doctor’s office when the physician is a personal friend (choice B is correct). Social status is a measure of power and prestige. Someone with high social status could also get an appointment quickly at a doctor’s office, but it would not be because the patient is in the
physician's social network, as the question stem stipulates (choice A is wrong). Cultural capital refers to non-financial assets that promote social mobility, such as education. Cultural capital is not relevant in the scenario described in the question stem (choice C is wrong). Charismatic authority is part of Max Weber's theory of authority. It describes power as a result of persuasiveness (choice D is wrong).

57. A  Psychoanalytic theory holds that people form unconscious defenses, or protections, from impulses or thoughts that create anxiety. In the defense of projection, people project, or attribute, painful impulses to other objects or people. Thus, the employee described in the question stem is projecting his sense of stupidity onto his computer (choice A is correct). Reaction formation occurs when people respond to situations in ways that are opposite the way they truly feel or think, because they unconsciously view their true feelings or thoughts as unacceptable (choice B is wrong). Regression is the psychoanalytic term used to describe a person who retreats to modes of thinking that are associated with earlier phases of psychological development in order to defend against unacceptable feelings or impulses (choice C is wrong). Sublimation is the conversion of an unacceptable impulse into a more acceptable form, such as converting an aggressive tendency into a job as a butcher (choice D is wrong).

58. D  Social constructionism describes the way that technologies, artifacts, and knowledge are imbued with the social relations (norms, values, etc.) of the society that created them (choice D is correct). The opposite of this perspective would be to describe technology as a value-free creation based on purely objective scientific knowledge (choice A is wrong). While technology is built from the collective effort of innovators, this is not the same type of “construction” described by social constructionism (choice B is wrong). Technology is the human response to environmental pressures, but the particular character of each technological response will be affected by the values of the groups that creates the technology (choice C is wrong).

59. B  The retina contains two types of photoreceptors known as rods and cones. Rods are highly sensitive to light, distinguish light from dark, and are found at the periphery of the retina. Cones are less sensitive to light, distinguish between colors and fine nuances of appearance, and are concentrated in the central area of the retina known as the fovea. Looking at a dimly lit object from the side of the visual field allows the rods, not the cones in the fovea, to capture the image (choice C is wrong). As noted, rods are highly sensitive to light and will therefore capture a clearer image than if one primarily used cones to apprehend the image by looking at the object head-on (choice B is correct). While it is true that viewing an object using peripheral vision results in the transmission of two images to the brain (choice D is wrong), this phenomenon does not result in greater clarity (choice A is wrong).