MCAT Psychology and Sociology Homework

Passage I (Questions 1-7)

This experimental psychology passage discusses the concepts of self awareness and individualization. It describes an experiment devised to investigate theories regarding these concepts.

Passage Outline

Paragraph 1: Self-concept is influenced by perceptions of others

Paragraph 2: Experiment: awareness condition-mirror, individuation-questions

Paragraph 3: Mirror = ↓ stealing, boys stole>girls, ↑ age = ↑ stealing

Figure 1: transgression rates by age

Question 1: B

The Looking Glass Self concept is the idea that humans define themselves in context of their social interactions. The second principle of symbolic interactionism is “social interaction is the origin”, thus answer (B) is the best choice.

Question 2: C

This suggests that the observers are not reliable judges of each child’s age. This casts doubt on the data gathered in the experiment. Therefore, the conclusion that rate of transgression increases with the age of the child is less established by the evidence collected, answer (C).

Question 3: C

Functionalism is the theory that every part of society has a function. Because it determines someone’s role based on their function in the larger structure of society, it must be rooted in macro sociology. Therefore, I is true. Symbolic Interactionism is often referred to as the Chicago School of Thought. Therefore, II is false. This is eliminates (A),(B), and (D). Therefore, (C) is the answer.

Question 4: D

This question suggests the child transgressed because of lack of means to afford snacks. Lack of finances are an external or environmental factor, as opposed to an internal orpersonality characteristic. Situational attribution is an explanation of behavior based on external or environmental factors, making answer (D) the best choice.

A consistency cue (A) would be a behavior commonly engaged in by the individual reflecting their personality. We don’t know anything about the frequency of the child’s transgressions and transgressions in other areas.

Fundamental attribution error (B) is the added emphasis on internal factors we have when making judgements on another person's behavior. The child's financial situation is an external factor, so this answer is opposite.

A dispositional attribution (C) is an explanation of a behavior based on personality or internal factors. Finances are an external motivator, making this opposite as well.

Question 5: A

Personal details required the children to think of themselves. When they then saw themselves taking the candy, they had been primed to think of themselves, and thus the costume had less of an effect of masking their self concept, making it harder to transgress, answer (A).

Question 6: C

Just like the children's actions originate in their social interactions, the adult's action also originate from their social interactions. By choosing to avoid leaving unattended candy, the adults have taken social action as a result of their previous social interaction with the children.

Question 7: B

Let's examine each answer separately.

Answer (A) Asch's length of lines study looked at the influence of social pressure on decision making. If the group chose an incorrect answer, would an individual choose the incorrect answer as well?

Answer (B) Zimbardo's prison studied investigated conformity to social roles. Individuals assigned to prisoner and guard roles fell into specific patterns of behavior for each. Based on the perceived status by others and position guards and prisoners adopted behaviors of power and obedience respectively. Paragraph one states that the theory studied in this passage is influenced by interpersonal relationships and perceptions of others. Both cases deal with external factors and perceptions (situational attribution) making (B) the best answer.

Answer (C) Milgram's obedience study looked at obedience to authority in the light of causing harm or death to an individual.

Answer (D) Sherif's Robbers Cave study looked at how conflict and competition can breed prejudice.

Passage II (Questions 1-4)

This passage discusses the seemingly paradoxical enjoyment runners derive from an activity that causes pain and discomfort.

Passage Outline

Paragraph 1: Endurance activities may fulfill needs

Paragraph 2: Increased focus on health and wellness

Paragraph 3: Runners report sense of community and satisfaction despite pain

Question 1: B

Competence entails excelling at difficult tasks, autonomy is the need to be in control, and relatedness is the need to feel accepted. These elements are all addressed in the final paragraph, making (B) the best answer.

Question 2: D

Pain is a negative stressor but there are also positive stressors mentioned such as the challenge of finishing a marathon leading to a sense of accomplishment, answer (D).

Question 3: B

Because her initial motive was weight loss, it was extrinsic (a specific reward) however, the motive shifted to both internal and external when her focus was more than just a health goal, answer (B).

Question 4: C

The sense of belonging is an element of Love and Belonging. The sense of achievement and control are elements of Self Esteem, matching perfectly with answer (C).

Passage III (Questions 1-6)

This is an informative psychology passage discussing the ELM model of behavior change using HIV education as an example.

Passage Outline

Paragraph 1: ELM→ central route=↑ likelihood of change

Paragraph 2: Peripheral route→ stronger at first, but change is not lasting

Paragraph 3: ELM for HIV testing

Question 1: D

The question asks why the CDC would choose HIV positive individuals for their program. If the goal of their program is to provide last change, will they want to be acting through the central or peripheral route? The passage tells us that the central route is more lasting. When is the central route used? The passage tells us individuals use the central route when they “are highly invested or motivated in the subject”.HIV positive individuals will certainly be more invested and motivated than HIV negative individuals or those with an unknown HIV status because the issue is more personally relevant to them. Answer (D) matches perfectly.

Question 2: B

The question asks how ELM explains patients not completing antibiotic treatment regimes as instructed by their doctors. Which route, central or peripheral, is this an

example of? As discussed in the passage, the peripheral route is characterized by non-lasting change. Starting antibiotics but not completing them is an example of non-lasting behavior change. At first, the patient is influenced by his/her mood (one of the factors influencing the peripheral route) because he/she feels ill. As the patient feels better, this mood motivation wanes, and the patient is less likely to finish the drug. Answer (B) is the best answer.

Question 3: A

This question asks which of the listed factors will not affect the likelihood of treatment compliance. Social facilitation is the improvement in the performance of simple tasks in the presence of others. Treatment compliance is a question of motivation, not skill, so social facilitation won't affect compliance. Group polarization is when groups makes more extreme or polarized decisions than an individual would, and would certainly influence compliance. Peer pressure certainly would as well. Socialization is the process of accepting and implementing behaviors in a community and would also be likely to increase compliance. Answer (A) is the best answer.

Question 4: C

Which is an example of a change in behavior causing a change in attitude? Cognitive dissonance refers to a feeling of discomfort when an individual holds two conflicting beliefs. This may lead to to a change in attitude, but cognitive dissonance itself is simply the feeling of discomfort. Observational learning is a change in behavior based on observation. While it might change behaviors, it won't have an affect on attitudes. The foot in the door phenomenon is when agreeing to a small task increases the likelihood of agreeing to a larger task. Here we see a behavior (the small task) changing an attitude (increasing the likelihood agreement). Because this is true, attitudes must be able to be changed by behavior so answer (D) cannot be correct. Answer (C) is the correct answer.

Question 5: C

This question asks which of the examples would induce change in individuals with low need for cognition. As stated in the passage, these individuals will experience change via the the peripheral route. The peripheral route is influenced the frequency of hearing the argument, mood, and qualities of the presenter.Roman numeral I fits this description. Experts and fit individuals address the presenter issues and putting the message out through several media outlets will increase the frequency of exposure to the message. Roman numeral II does not meet the criteria. A thorough discussion of research would require full engagement of the listener which the low need for cognition individual would be unlikely to fulfill. The short and frequent ads in Roman Numeral II fit the bill for the same reasons as RN I, thus making (C) the best answer.

Question 6: C

This question wants to know which strategy would increase childhood vaccination. At first, you may be tempted to identify the strategy with the central route strategies.

However, in contrast to medication compliance or fitness routines, vaccinations are (for the most part) a one time deal. Individuals don't need to show up to the gym everyday or take a pill every morning, they simply need to bring their child in once. Thus, the more effective strategy in this case will be via the peripheral route, which according to the passage tend to produce stronger initial results. Having experts and celebrities speaking frequently at pharmacies fits the description of the peripheral route (frequent message, quality presenters), making answer (C) the best answer. Answer (B) uses fear as a motivator which was not discussed in the passage. Answers (A) and (D) are both examples of central motivators.

Passage IV (Questions 1-5)

This passage describes the ultimatum game in theory and goes on to discuss two different examples of the theory.

Passage Outline

Paragraph 1: Ultimatum game-one person splits sum, second person accepts or denies

Figure 1: Extensive form of UG

Paragraph 2: Likelihood of game played multiple times explains player 2 lack of optimal play

Paragraph 3: Big/Little Monkey example

Figure 2: Big/Little Monkey form of UG

Question 1: A

The passage tells us that player 2 rejecting offers of 30% or less is suboptimal. Why might they do this? Perhaps they feel insulted by the low offer and have a desire to hurt or annoy (spite). This is not a selfish action, as they don't gain anything by rejecting the offer. Costly signaling refers to a sacrifice in order to signal status. By rejecting the offer, they sacrificed the sum offered to them, but no increase in status would be seen. Negative reinforcement is when the removal of a negative event increases the rate of the behavior and would not be the case in this situation. Answer (A) is the best answer.

Question 2: D

This question essential asks us to identify the best decisions for little monkey when going first and second, assuming that big monkey will make optimal decisions. Looking at the first diagram where little monkey (LM) decides first, we see two scenarios. If he waits, he will either get nothing or a 50/50 split. If he climbs he will either get 10% or 30%. The best move here would be to wait, because we know that big monkey (BM) will choose the more optimal 50/50 split. When choosing second, things are a little more complicated. If BM waits, LM can get 0% or 10% by waiting or climbing respectively. If BM climbs, LM can get 40% or 30% by waiting or climbing respectively. We see that by choosing the opposite of BM the LM gets the best "deal". These observations are best reflected in answer (D).

Question 3: B

This question asks us what is the expected payout for BM is both BM and LM make their decisions based on a fair coin. A fair coin would mean that each decision has a .50 probability of occurring. Thus, each of the four outcomes has an equal opportunity of occurring. BM's expected payout will simply be the average of his payouts. (0+4+9+5)/4=4.5. Answer (B) matches.

Question 4: B

This question asks what is true of a community in social trap where an individual is acting in his own best interest and hoarding water during a drought. A community with is sense of Gesellschaft is characterized by having rational will, where the good the whole is valued over the self. Thus, a community with a lack of Gesellschaft might be more likely to experience hoarding.

Question 5: A

This question asks for a likely consequence of the punishment of non-signalling. Because the whole group participates in punishing a non-signaler, a single monkey that attempts to infiltrate the group to take advantage of the signalling would be unsuccessful (answer B). The punishments will likely lower the status and fitness level of the transgressor, resulting in decreased ability to mate and propagate his genes for selfishness (answer A).

High Yield Science Wrap-Up

Passage I (Questions 1-7)

This is a descriptive physics passage discussing the mechanism of myopia and the strategies used to correct it.

Passage Outline

Paragraph 1: Cornea and lens contribute to power of eye. Cornea-most power. Lens-fine adjustments. Ciliary muscles contract=↑ convex

Paragraph 2: Myopia-lens is too powerful. Near vision good, long vision bad.

Paragraph 3: Diverging lenses for myopia correction

Paragraph 4: Lens maker equation

Question 1: B

We know this person is myopic, therefore they'll need convex lenses to correct their vision. Convex lenses have a negative focal length, and so will also have a negative power. We can cross off A and C right away. If we're running out of time, we'd simply pick either B or D and move on. Stars are essentially found at an infinite distance, so we can approximate 1/o as 0. From that we can say that f=i for our myopic eye. The total power of the myopic eye and the contact lens is equal to the power of the unaccommodated eye (15.8 + 43 diopters). The distance between lenses is assumed negligible so we can simply add up the $P_{myopic\ eye}$ and $P_{contact}$ to get P_{normal}.

$1/f = 1/o + 1/i$

$f_{myopic\ eye} = 1$ cm

$P_{myopic\ eye} = 1/(10\text{-}2\ m) = 100$ diopters

$P_{normal} = P_{myopic\ eye} + P_{contact}$

$P_{contact} = 15.8 + 43 – 100$

$P_{contact} = -41.2$ diopters

This matches best with answer (B).

Question 2: D

Because external and internal radius of curvature are mentioned, we likely have to use the lens maker equation. We know that the human lens is a convex lens, so right away we can eliminate our negative powers (A and C). Remember that focal length is often given in centimeters while a diopter is defined as a m^{-1}.

$1/f = (n-1)(1/r1 – 1/r2)$

$1/f = (1.4 - 1)(1/10 + 1/6)$

$1/f = (0.4)(16/60) = 32/300 \sim 1/10$

f = 10 cm = 0.1 m

P = 1/f = 10 diopters

This matches best with answer (D).

Question 3: B

What happens to the lens when the muscles relax? It said directly in the passage that *when the ciliary muscle is relaxed … the lens becomes less convex*. The unaccommodated lens is useful for far away objects, however an accommodated lens is needed for viewing nearby objects. With this muscle relaxant, the image of nearby objects would converge behind the retina (as the focal length would be too weak), and so the person wouldn't be able to see a clear image. This matches best with answer (B).

Question 4: B

From the positive power, we know this is a convex lens. What equation can we use for this? We're going from a distance of 5 f to a distance of 0.25 f in the question. You may recall a table for convex lenses, and that for a convex lens objects greater than the focal length are smaller and objects less than the focal length are bigger. Objects are the focal length will not form an image. Without recalling a table or these rules, we can plug values into the equation 1/f = 1/o + 1/i, and make some judgments.

First, lets consider where the image starts at 100 cm.

1/f = 1/o + 1/i

1/20=1/100 + 1/i

4/100=1/i

i=.25

m=-i/o

m=-25/100

At a distance of 100cm, our image is virtual because the magnification sign is negative, and reduced.

Next, let's consider a distance closer to the lens, but still great than the focal length (which in this case is 20cm), such as 50.

1/f = 1/o + 1/i

1/20=1/50 + 1/i

3/100=1/i

i=33

m=-i/o

m=-33/100

At the focal length.

1/f = 1/o + 1/i

1/20=1/20 + 1/i

0=1/i

i cannot equal 0 so there will be no image at the focal point.

And less than the focal length.

1/f = 1/o + 1/i

1/20=1/10 + 1/i

-1/20=1/i

i=-20

m=-i/o

m=20/100

Thus, an object at a distance less than the focal length will be smaller or reduced. Putting all these scenarios together matches best with answer (B).

Question 5: A

You should realize that hyperopia is the opposite of myopia which was discussed in the passage. What type of lens will help focus light? Myopia was corrected for with diverging lenses, so hyperopia must be corrected with converging lenses. A converging lens is a convex lens, one that is thicker in the center and thinner along the edges.

Question 6: D

What equation will help us with this? The refractive index of the cornea is given as 1.38 from the passage. As light rays go from air (n=1) to the cornea (n=1.4), they must decrease in speed (n=c/v). The frequency of light (as with all other waves) is defined by the source, and so remains constant across mediums. If speed decreased but frequency remains constant, we know that λ decreases ($v = f\lambda$). The last property is intensity, which must decrease as not all light will have refracted, some will have reflected off its surface. This matches best with answer (D).

Question 7: A

What equation will help us with this? Myopia is corrected for with concave lenses – this is mentioned directly in the passage, but this should also be background knowledge. Concave lenses have negative focal lengths. The refractive index doesn't determine whether or not focal length will be negative; all that's necessary is for r_2 to be greater than r_1.

Passage II (Questions 1-5)

This chemistry passage discusses redox reactions and electrochemistry, using the electrolysis of water as an example.

Passage Outline

Paragraph 1: Hydrogen has numerous industrial uses

Paragraph 2: Hydrogen is produced via electrolysis of H_2O. Free hydrogen reacts w/ O_2 in air

Figure 1: Electrolysis of H_2O

Paragraph 3: Description of electrolysis cell

Paragraph 4: Cathode and anode reactions

Question 1: D

This is a classic two-part problem, an MCAT staple. It is important to solve these problems piece-by-piece, rather than trying to solve both parts simultaneously. In all electrochemical cells, electrons flow from anode to cathode. This is part of the definition of anode and cathode, in fact. So A and B can be eliminated. Now a little additional thought is required. Remember that in an electrolytic cell, the (-) cell is the cathode. A is connected to the (-) pole of the battery, so it is the cathode, and hydrogen is generated at the cathode, according to ¶3.

Alternatively, you can reason your way through the fact that electrons flow out of the negative plate of a battery, so electrons are flowing into the electrode inside test tube A. Of the two reactions in ¶3, the one which results from the addition of electrons is the generation of hydrogen. Both of these strategies lead us to answer (D).

Question 2: B

This question covers a fairly fundamental aspect of electrochemistry, which is that pure water is not actually a very good solvent for these reactions. Since water has a fairly low autoionization constant (10^{-14} at room temperature), pure water has fairly few ions dissolved in it, which means that it conducts electrical current fairly poorly. As ions are created during the operation of the electrochemical cell, ions will gather around the electrodes, creating a charge gradient and further decreasing the effectiveness of the apparatus.

Water, however, is an excellent solvent for ionic compounds, which readily dissociate, leaving a large number of ions which can be attracted to the ions formed at the electrodes, canceling the electric gradient and maintaining the effectiveness of the cell for longer. Strong acids and bases are desirable electrolytes, due to their very high solubility. This matches well with answer (B).

Question 3: B

We are provided current and time and asked to calculate the volume of gas evolved in the cell. 22.4L is the volume of a single mole of gas at STP, and a number absolutely worth memorizing for the MCAT. Plugging in values, the calculation is as follows:

$It = nFe$

$20*600 = n(10^5)(4)$

$12x10^3 = 4x10^5\ (n)$

$n = 3x10^{-2}$ mole

$3x10^{-2}$ mole * 22.4L = $67.2x10^{-2}$L = 672 mL

Question 4: C

There aren't a ton of reactions you are expected to know off the top of you head on the MCAT, but the reaction of alkali metals with water is absolutely one of them. The generic reaction is:

$2\ M(s) + 2\ H_2O\ (l) = 2\ MOH(aq) + H_2(g)$

Note that reactivity increases as one goes further down the periodic table, so lithium is mildly reactive, sodium fairly so, while K and Rb are quite dangerously reactive; the reactions are so exothermic that the heat released rapidly ignites the released H_2 gas. Of those listed, K, answer (C) is the best choice.

Question 5: D

Many atoms have multiple possible oxidation states, but there are several that, especially in ionic systems, only have one possible oxidation state. Oxygen is one of these; in ionic compounds, its oxidation state will always be -2. The dichromate ion is an ionic system, so the 7 oxygens are -2 each, for a total of -14. Whatever the Cr atoms are, two of them plus (-14) must equal -2, the overall charge of the ion. Hence, the charge of each Cr atom is +6, or +12 total for the two.

Passage III (Questions 1-6)

This passage discusses the use of spectrophotometry in determining concentrations of gases and then goes on to describe a student run experiment on kinetics.

Passage Outline

Paragraph 1: concentration can be calculated by absorbance

Figure 1: Spectrophotometer diagram

Paragraph 2: Beer-Lambert's Law A=bc

Paragraph 3: Kinetic experiment description

Paragraph 4: Trials varied concentrations and temperatures

Table 1: Experiment results

Question 1: B

Is reaction endothermic or exothermic? Endothermic. What happens to the system when we add heat? The forward reaction should increase, which should cause the color to decrease. Why are C and D are wrong? When we increase temperature, we are increasing the rate of both the forward and reverse reactions, they are just increased different amounts (depending on if this is an exothermic or endothermic reaction). So for this reaction, both the forward and reverse rates of reactions are increased, but the forward rate is increased more than the reverse rate. As the products begin to build up, the forward rate will decrease and the reverse rate will increase until the system reaches dynamic equilibrium, and the rates are once again equal.

Question 2: D

This could be considered single-replacement, but that's not an option. In this case it might be fastest to eliminate. A, B, and C can all be eliminated. We can confirm D by checking oxidation numbers.

What is a combustion reaction? When a hydrocarbon reacts violently with oxygen to make water, heat, and carbon dioxide. What is a double-replacement reaction? When an ion/functional group on one molecule switches places with the ion/functional group on another molecule. This reaction could potentially be classified as a single-replacement reaction (the oxygen moves from NO_2 to CO) but not as a double.

What is a hydrolysis reaction? One which involves the addition of water to cleave bonds. What is a redox reaction? One in which the oxidation number of species changes over the course of the reaction! This is true for this reaction. We have a species being oxidized in this reaction (carbon), and one which is being reduced (nitrogen). One species is the oxidizing agent (nitrogen) and one which is the reducing agent (carbon).

Question 3: C

What is the rate law for the reaction described in the passage? A and C match the order but differ in units. Only C has the correct units for this reaction. We don't only need relative rates and concentrations to determine the overall reaction order from rate kinetic experimental results. How do the concentrations of species change from Trial 1 to Trial 2, and from Trial 1 to Trial 3? When we double pressure (while keeping everything else constant), we've halved the volume and thus doubled the concentration of species.

Which two trials should we compare to find the order of carbon monoxide ? (1 and 3). Which two trials should we compare to find the order of NO_2? The answer is 1 and 2, using the order of CO from the previous comparison.

From the experimentally-determined rate orders, we're now stuck between choices A and C, which only differ in the units of their rate constant. What units should there be for $\Delta P/\Delta t$? Ms^{-1}! Only C has the correct units.

Question 4: B

What is Q for this reaction and how does it compare to K_{eq}? Will the reaction need to shift to the left or right? What species is measured by absorbance? Because $Q>K_{eq}$, the reaction will shift to the left. NO_2 absorbs light in the visible range so absorbance will increase over time. We started with some initial concentration of NO_2, so the initial absorbance should be non-zero. This matches well with answer (B).

Question 5: D

What is the formula that relates the variables given to rate? Solving the equation, we find -10^{-4} M s^{-1} is the correct value for the rate. (Answer D)

$A = \varepsilon bC$

$A = - \mathit{log}\ (I/I_o)$

$I_o = 998\ W/m^2$

$\varepsilon = 5.04 \times 10^2\ cm^{-1}M^{-1}$

$b = 1cm$

$\Delta A = - \mathit{log}(102/998) + \mathit{log}(11/998) = -1$

$\Delta C = -1 \div (5 \times 10^2\ cm^{-1}M^{-1} \times 1cm) = -0.002\ M$

$\Delta C/\Delta t = -2 \times 10^{-3}\ M \div 20\ s = -10^{-4}\ M\ s^{-1}$

Question 6: C

What is the formula that relates the variables given? $\Delta G = \Delta H + T\Delta S$ and $\Delta G = RT\ \mathit{ln}(Q/K_{eq})$. Because the reaction is exothermic, ΔH must be negative (statement II). This is the only necessarily true statement.

I. If ΔS is positive, then ΔG will be negative at some temperatures and positive at other temperatures [Δ G = pos + T(neg)]. At which temperature will ΔG be positive? Low temperatures. For which will it be negative? High temperatures.

II. If ΔS is positive, then the ΔG will always be negative (Δ G = pos + pos).

III. If ΔG is positive, $Q>K_{eq}$ according to the equation $\Delta G = RT\ \mathit{ln}(Q/K_{eq})$. You will need to know basic applications of logarithms, i.e., that the log of a number between 0 and 1 is negative.

Why is IV wrong? The forward rate of a reaction is only equal to the reverse rate of a reaction for those at dynamic equilibrium!

Passage IV (Questions 1-4)

This biology passage on respiration also pulls in topics from physics (surface tension) and chemistry (pH). Critical analysis of the graph is needed to answer one of the more challenging questions in this section.

Passage Outline

Paragraph 1: Alveoli tend to collapse, prevented by surfactant

Paragraph 2: Premie babies lack surfactant. Given surfactant to prevent collapse. Experimental design.

Figure 1: Surface tension results

Question 1: B

This question asks what will happen in a baby born without adequate surfactant. Without surfactant, the alveoli will be more likely to collapse. The second paragraph tells us that the collapse of alveoli "increases the energy required to breathe and decreases the surface area through which gases can diffuse". The decrease in surface area to diffuse as will result in less O_2 being absorbed, more CO_2 being retained and this, combined with the increased energy being expended will decrease the pH (increase in acidity).This decrease in pH is secondary to the production of lactic acid from the increased activity in the muscles of respiration, answer (B).

Question 2: C

This question asks us which choice will decrease the surface tension the most if a fourth trial is done. To answer this question, we need to refer back to the first paragraph where it tells us that "alveoli are prone to collapse due to the surface tension from the air-liquid interface". Based on this, decreasing the air-liquid interface will decrease the surface tension. If we remove the air, there will be no air-liquid interface, and we will see the least amount of surface tension. (A) and (B) can both be eliminated because they are gases. (C) and (D) are both liquids, but answer (D) still contains some gas, so sodium chloride solution (C) will produce the lowest air-liquid interface and is the best answer.

Question 3: D

Looking at dish 3 on the graph from the passage we see that as surface tension decreases, we see a corresponding decrease in surface area. We know that surfactant decrease surface tension, so we can conclude that decreasing the water to surfactant ratio will result in a decrease in surface tension. Thus decreasing the water to surfactant ratio also corresponds to a decrease in the cell surface area. This matches best with answer (D).

Question 4: B

This is a pseudo discrete question that essentially asks us where blood will back up to if blood flow is impeded in the lungs. How does blood enter the lungs? Via the pulmonary arteries (answer B). Blood exists via the [pulmonary veins.

Passage V (Questions 1-5)

This organic chemistry passage discusses protein structure and also brings in some general chemistry topics like VSEPR theory.

Passage Outline

Paragraph 1: Discussion of protein structure

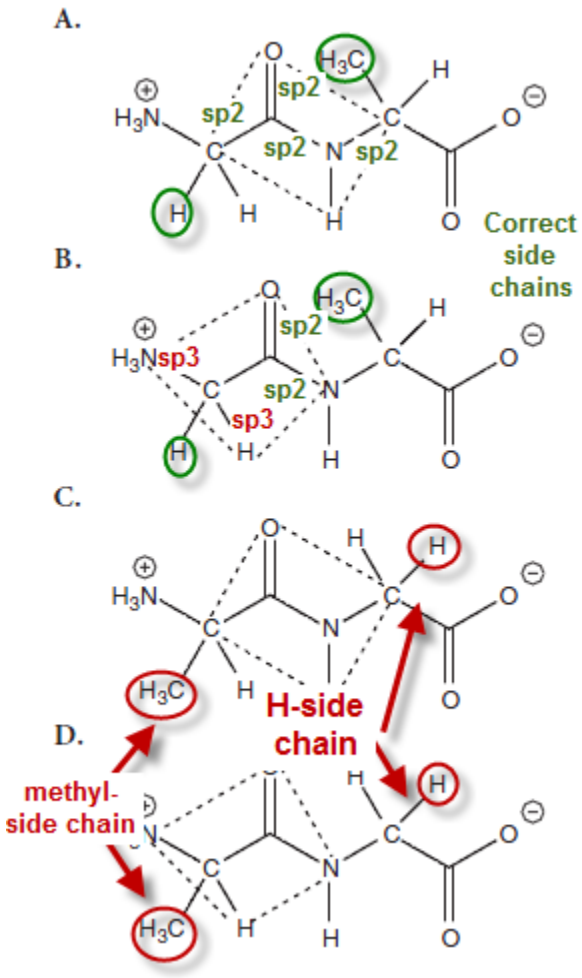
Paragraph 2: Peptide bond is planar

Figure 1: Peptide bond conformations

Paragraph 3: Disulfide links play role in determining relationships between AA

Question 1: A

We can eliminate answers (C) and (D) right away because the question tells us the dipeptide in question is Gly-Ala, and as such the first side chain should be hydrogen and the second, a methyl group. Answers (C) and (D) show the opposite configuration. We then need to recall that sp^2 hybridized bonds will all be found in the same plane. Answer (A) shows all sp^2 hybridized bonds, while answer (B) contains several sp^3 hybridized bonds which because of their bond angle will not be in the same plane.



Question 2: D

This question is best solved through process of elimination. We do not have a good nucleophile, so both (A) nucleophilic substitution, and (C) nucleophilic addition can be eliminated. This leaves us with reduction and oxidation, so we know we are dealing with a redox reaction. Now we just need to whether cysteine is reduced or oxidized. The structure of cysteine makes determining oxidation numbers for it a little tricky, so here it's probably easier to look at I. We see I_2 in the reactants with an oxidation state of 0 going to an oxidation state of -1 in the products. It has therefore gained an electron and been reduced. If I is being reduced, then cysteine must be undergoing oxidation, answer (D).

Question 3: C

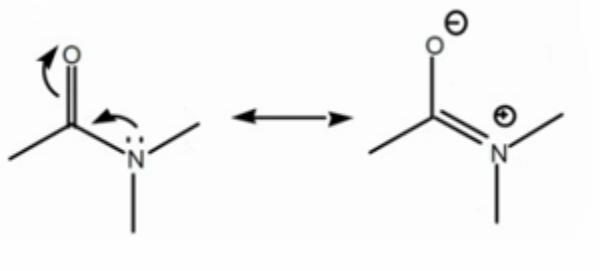
We are asked in this question to state which is true of most peptide bonds. The two variables in the answer choices are cis vs. trans and excess vs. lack of bond strain. Will cis or trans be more common? Trans are typically more common. Why? Because the trans configuration places the functional groups farther apart than the cis configuration, thus minimizing nonbonded strain. This matches best with answer (C).

Question 4: C

This question asks us what conclusions we can make after observing that molecular weight doesn't change after cleavage of disulfide bonds. If the protein had quaternary structure that depended on disulfide bonds we would expect to see a change in molecular weight, thus answer (D) can't be correct. We can safely say that because the molecular weight DIDN'T change, that the molecule lacks quaternary elements dependent on disulfide bonds. However, elements of quaternary structure may still exist that don't depend on disulfide bonds (answer A), or none may exist at all (answer B). We don't have enough information to support (A) or (B), so (C) is te best answer.

Question 5: C

This question again tests our knowledge of the planar nature of the peptide bond. As discussed in question 1, sp^2 hybridized bonds all fall within the same plane, while sp^3hybridized bonds lie in different planes. Thus, a conclusion that definitely can NOT be made is that the nitrogen in the peptide bond is sp3 hybridized (answer C). Observing the resonance structures for the peptide bond show the partial negative charge on oxygen and the partial positive charge on nitrogen.



Passage VI (Questions 1-4)

This is a biology passage discussing mendelian and population genetics using thalassemia as an example.

Passage Outline

Paragraph 1: Thalassemia minor-heterozygotes, major-homozygotes

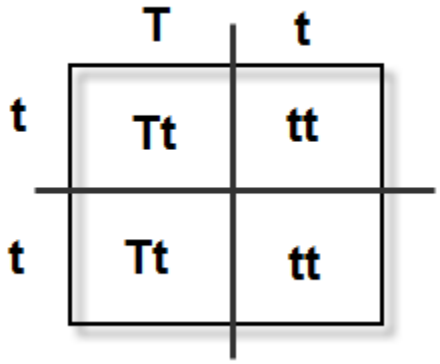
Paragraph 2: α-thalassemia are deletions in the α chains

Paragraph 3: β thalassemia: homozygotes-severe, heterozygotes-asymptomatic

Paragraph 4: β thalassemia caused by a number of different mutations

Question 1: A

The passage tells us that thalassemia major is homozygotic and minor is heterozygote, thus our punnett square will be crossing a heterozygote and homozygote. We thus has a 50% chance of producing a child with thalassemia major for each mating opportunity. Because each mating is an independent event, we multiply probabilities, .5 x.5 x .5=12.5%, answer (A).



Question 2: B

What will happen is we have a mutation in the promoter region? What process is the promoter region involved with? It is involved in transcription, so it is likely such a mutation would disrupt transcription (answer B) Although translation is “downstream” of transcription, we can’t make any conclusions on a promoter mutation’s effect on translation (answers A and D).

Question 3: D

This is a Hardy-Weinberg question. The key to these questions is identifying the given data appropriately and making careful calculations. We are told that 16% of the population has thalassemia major. Is this going to be q or q^2. Phenotypes are typically the squared terms, while alleles are the non-squared terms, thus we can say that q^2=.16. From here, we solve for p and q. Next the question asks us to solve for heterozygotes which will correspond to 2pq. The calculations are as follows:

q^2=.16

q=.4

p+q=1

p+.4=1

p=.6 p^2+2pq+q^2=1

2pq=2(.4)(.6)=48%

Question 4: D

Where will transcriptional repression occur? This question is essentially asking “where does transcription occur”? (Transcriptional regulation or repression will all happen at the same location where the actual process occurs). Transcription occurs in the nucleus, so transcriptional repression will occur in the nucleus as well (Answer D).