Lessons learned

MCAT Chemistry   
N2(g) + H2(g)  NH3(g)

Q 29: Oxidation always occurs at the anode   
Reduction always occurs at the cathode.   
N2 gets reduced (Gain of Electrons = GER)  
H2 gets oxidated (Loss of Elections = LEO)

Q 31: Lewis base is a substance that easily donates an electron pair, forming a covalent interaction.

Q 32: Solid State catalysts increase the amount of product produced per unit time.   
  
Q 33: Identify key details. Proton conductivity of SCY increases with increasing temperature, therefore it makes sense when designing an ideal reactor to keep the SCY temperature higher then electrode temperature.

Q 34: When a at 25 C means that the overall reaction is Spontaneous with Negative . A huge tell that is such a large number meaning it favors the reaction.

Q 35: Read and identify key details. The question asks for the second step in a step wise reaction.   
  
Q 36: In [Cu(NH3)4]2+ the bonds between the Cu2+ and the nitrogen atoms of the ammonia molecules are a coordinate covalent bond. A Lewis acid-base interaction between metal cation an electron pair donor is a coordinate covalent bond.

Q 37: [Cu(H2O)4]2+(aq) + 4NH3(aq)  [Cu(NH3)4]2+(aq) + 4H2O(l)   
if HCL (Hydrochloric acid) was added it would protonate ammonia and reduce the amount ammonia present. By le chatelier’s principle the equation will shift to the left to compensate, decreasing the amount [Cu(NH3)4]2+(aq).

Q 40: in examining lowest second ionization energies, two requirements are needed. The valence electrons and for them to be an alkali earth metal.

Q 42: Practice ph / Henderson- hasselbach equation: ph = pKa + log ([base] / [acid]).   
pH = 6.37 + log (0.2 /2)

pH = 6.37 + log (0.1)

pH = 6.37 – 1  
pH = 5.37

Q 43: Using the solubility constant *K*sp for CaCO3 is 4.9 × 10–9

And CaCO3 dissolves into equal parts [Ca2+][CO32–].  
Ca2+(*aq*) + 2HCO3–(*aq*)  CaCO3(*s*) + CO2(*g*) + H2O(*l*)

4.9 x10^-9 = [x][x]

49 x10^ -10 = [x]^2  
take square root of both sides  
7.0 x10^-5 = [x]

Q44: in a blood pressure reading:

Q 47: number of charges in excess can be computed as +3.2 × 10 –9C/1.6 × 10 –19C = +2.0 × 10 10. This means that the rod has an excess of positive charge, created by removing a number of +2.0 × 10 10electrons from the material

Q 48: The smallest bond in a molecule will be between an atom with the smallest atomic radius. In the case of nitroglycerine C-H bond is the smallest bond within the entire molecule. Q 48: the smallest bond present in nitroglycerin involves the smaller radius in Hydrogen and Carbon

Q 49: calculate : 2(364.0)nitro – 6(393.5) CO2 – 5(241.8)H20 = -2842 kJ / mol   
original equation: 4C3H5N3O9(l) → 12CO2(g) + 10H2O(g) + 6N2(g) + O2(g)  
two moles worth: 2 C3H5N3O9(l) → 6CO2(g) + 5H2O(g) + 3N2(g) + O2(g)

Q50: At STP 1 mole of substance occupies 22.4 L/ mol.   
original equation: 4C3H5N3O9(l) → 12CO2(g) + 10H2O(g) + 6N2(g) + O2(g)  
lowest mole formula: C3H5N3O9(l) → 3CO2(g) + 2.5H2O(g) + 1.5N2(g) + O2(g)  
At STP 1.5 moles N2(g) x 22.4 = 33.6 L

Q52: power formula: P = PE / time = mgh/t  
from table data: P = (54kg x 10m/s^2 x 30 steps x 0.15 m/ step) / (27s) = 90W  
540\*3 = 16,200   
16,200x0.15 m è 2430

2430/27 = 90 W

Q 53: work done (W) = ½ k  
W = 0.5 200 (N/m) x (0.2m)^2  
W = 4.0 J

Q54: sound waves 20 db and 40 db have a difference of 20 db, meaning a decimal log of 2. The ratio of these two differences is 100 or (1.0 x 10^2)

Q 54: lenses with a negative focal length are diverging lenses. These lenses form virtual and reduced images of objects further than the focal length.

Q 55: half life formula:   
=1/2^2  
= ¼ of radioactive element is left.   
  
Q 57: describing a battery powered resistive circuit when current is flowing, electric energy is being converted into chemical energy to thermal energy.  
chemical energy of the battery elements is used as electrical energy to set the charge carriers in motion through the resistor, where they experience drag from the crystal lattice of the resistive conductor and dissipate their energy as heat from the resistor.

Q 58: protein secondary structure is best characterized by the pattern of hydrogen bonds between the backbone amide protons and carbonyl oxygens.   
  
Q 59: How to solve for resistors in series:  
1/s1 + 1/s2 = 1/series   
eg 1/60 + 1/20 =   
2/120 + 6/120  
8/120   
4/60  
2/30  
==1/15  
inverse   
è 15 final answer.

Biology section   
Q5: Examine the balanced formula  and by le Chatelier's principle, to make the most phosphine (PH3) requires a low pH= pH < 4.  
  
Q6: slow down! The passage says that phosphine reacts with sulfhydryl groups AND the ONLY AMINO ACID containing sulfhydryl groups is cysteine (CYS, C).  
  
Q7: Examine the question. The chart states that the activity decreases mitochondrial ATP production. Energy production will shift to **glycolysis** to compensate for the change.

Q8: phosphofructokinase-1 inhibition is caused by both allosteric regulation where binding to a regulatory site other than the active site of the enzyme and feedback inhibition where the end product will downregulate the enzyme.   
  
Q9: in order to maintain a high concentration of CL- ions inside a cell, the ions must be moved against their concentration gradient which requires energy.   
  
Q10: Dendrotoxin from a mamba snake blocks voltage-gated potassium channels in somatic motor neurons that regulate skeletal muscle contraction. This works by prolonging the action potential and causing excessive muscle contractions.   
  
Q13: Proteins with an isoelectric point ~9 are positively charged at physiological pH.   
secretory proteins are synthesized in the rough endoplasmic reticulum.   
folding of secretory proteins happens in the rough endoplasmic reticulum.   
  
Q14: transcription factor proteins require a nuclear localization sequence to be translocated into the nucleus.

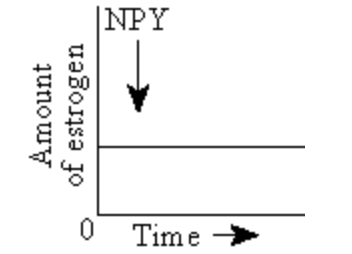
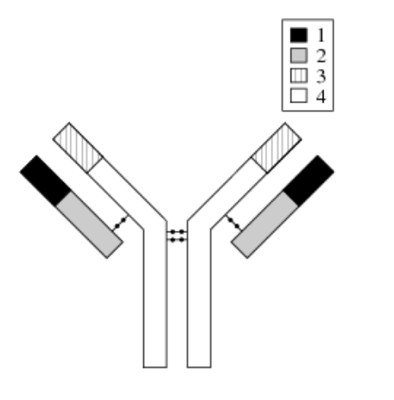
Biology section   
Q:5  In the balanced equation, AIP uses H+ to form the products. By having low pH <4 would have the highest yield of PH3.

Q6: Cystine is an Amino acid containing a sulfhydryl group (S-H).   
  
Q7: If the electron transport chain is stopped, the next alternative for energy production (ATP) is glycolysis.   
  
Q8: the mitochondrial complexes need to be studied separately to avoid cross inhibition disrupting results.   
  
Q10: allosteric regulation- binding to a regulatory site other than the active site of an enzyme   
feedback inhibition – the end product inhibits further synthesis. Eg ATP inhibiting phosphofructokinase-1   
  
Q12: Dendrotoxin from the mamba snake blocks voltage-gated potassium channels in somatic motor neurons that regulate skeletal muscle contraction by inhibiting the start of an action potential. If potassium ions channels are blocked, the membrane would fail to repolarize, extending the length of the action potential and simulating excessive muscle contractions.   
  
Q 13: When proteins have isoelectric points ~ 9, implying that in ph 7.2 are positively charged at physiological pH.   
secretory proteins are synthesized in the rough endoplasmic reticulum.  
folding of secretory proteins occur in the rough endoplasmic reticulum   
  
Q 14: in order for transcription factors to make it into the nucleus they require a nuclear localization sequence.   
  
Q 16: alpha- helical domains contain transmembrane domains contain hydrophobic (nonpolar) amino acids that are in phospholipid bilayer.   
  
Q 17: thiol groups(SH) are only possible with cystine amino acids

Q 21: GAPDH catalyzes the reversible reaction of glyceraldehyde-3-phosphate to 1,3-bisphosphoglycerate.   
  
Q23: post translational modification of proteins like histone acetylation is analyzed by western blotting.   
  
Q24: Vasopressin regulates the insertion of aquaporins into the apical membranes of the epithelial cells of the collecting duct.

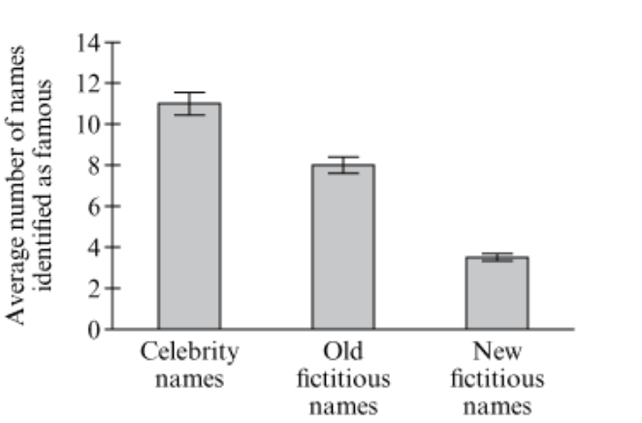
Q 26: Schwann cells are the myelin-forming cells in the peripheral nervous system.   
  
Q 29: Immediately after entering the blood stream from the small intestine the first major organ encountered by a bloodborne bacteria would be the **liver** where nutrients are regulated, and toxins are removed.   
  
Q 31: review homozygous vs heterozygous.  
review autozygous transmission  
  
  
  
Q33: According to the passage, GnRH is a potent stimulator of LH production, but there may be other hypothalamic factors that regulate LH secretion. Therefore, because the treatment conditions were control, NPY alone, GnRH alone, and GnRH + NPY, the researchers were testing whether NPY can modulate LH secretion.   
  
in the case of asking what the purpose of the study was: to determine whether NPY can modulate LH secretion.

Q 35: Pay attention to the details.   
  
Q 38: Read and trust yourself bro. Treatment with NPY alone was 0.28 ~ translating to a graph with no real increase == it is flat.

  
  
Q 40: double check and trust your gut.   
  
Q 41: double check answers  
  
Q 42: proteases digest proteins into smaller fragments.   
  
Q 43: addition of one nucleotide to the open reading frame in a transcript that does not make or eliminate a stop codon results in a frameshift mutation and frameshift mutation + aberrant carboxy-terminal domain.   
  
Q 44: review all steps in citric acid cycle and glycolysis.   
  
Q 45: glucose è (under aerobic conditions in glycolysis) è 2 moles of ATP from each mole of glucose.   
  
for 5 moles of glucose è 10 moles ATP = 6 x10^23 molecules / per mole  
final answer = 6x10^24  
  
Q 47: Heart, kidney and skeletal muscle are derived from mesoderm.   
brain is derived from ectoderm.   
  
  
Q49: Myosin (a motor protein) move along microfilaments through interactions with actin.   
Q 51: microtubules are cellular structures that originate from centrosomes.   
  
Q 52: Lytic granules mainly released from cytotoxic T lymphocytes (CTL’s) when the T-cell receptors bind to viral antigens presented on the surface of virus-infected cells.   
  
Q 56: identify the variable regions in antibodies.   
they are region 1 and region 3.  
  
  
Q 58: muscles stiffen after death because ATP is unavailable to bind and directly release the myosin head from the actin filament.   
during normal muscle contraction, ATP is required to break the bonds between the actin filament and the myosin head.   
  
Q 59: a protein run through SDS-PAGE matching 45 kDA standard. If there was any disulfide bridges, when the protein was run in a reducing environment the protein’s mobility should be seen at ~ 22.5 kDA.

Psychological and social section

in human eyes the fovea is directly involved in color sensations.   
  
occipital lobes are responsible for vision.  
somatosensory cortex is responsible for processing somatic sensations.   
temporal cortex is responsible for processing auditory information and encoding memory.   
motor cortex is responsible for supporting motor functions (movement).  
  
fixed ration schedule of reinforcement = subjects received a banana chip every time they correctly answered.   
  
historically the baby boomers from the 1946- 1964 are responsible for the increase of the population aged 65 and older in the US.  
  
a conflict theorist is likely to consider the relationship between **generational status, political power, and resource allocation.**

the linguist relatively hypothesis suggests that h**uman cognition is affected by language**. Therefore humans are better at distinguishing colors for which their language has a name.  
  
source monitoring errors – participants are likely to think of the old made-up names as famous names.   
  
A patient experiencing severe marital problems and reporting no memory of any life events surrounding the marriage and the spouse. Memory for other life events is intact. The patient is most likely diagnosed with a **dissociative disorder.** /

increases in dopamine activity are associated with increased reward-seeking motivation. An association between **dopamine levels and operant conditioning** which changes in behavior due to past outcomes.   
  
the us tends to have less social mobility then its peer countries. Leading scholars to question assumptions about opportunity in American society- examining if meritocracy is at all utilized.

Relative poverty refers to **social disadvantage by income or wealth as compared to the social advantages linked to income or wealth in a society.**

The socioeconomic gradient in health refers to the graded relationship between social class and health, in which each “step” up on the hierarchy of social stratification tends to be associated with better health.   
  
fundamental attribution error refers to stressing the **importance of dispositional (i.e., personality) factors** in one’s explanations of other people’s behavior and underemphasizing situational factors.  
  
Schematic processing is relevant to explaining response times during the IAT because the speed with which memory schemas (organized clusters of knowledge) are activated and processed is presumed to indicate the participant’s implicit attitude.

For socially sensitive topics such as weight, participants may be more likely to provide socially acceptable answers during interviews or phone surveys. Internet responses do not elicit the same level of social desirability.  
  
health providers often overlooked (situational behavior) the consequences of discrimination and poverty in explaining their patients’ behavior.   
  
drug craving = strong desire to ingest a drug.   
  
agonist= a molecule or substance that activates a physiological response after binding to its receptor.  
  
antagonist = drug that blocks receptors by attaching to the target receptors without activating them.

Social loafing refers to the fact that people are more productive alone than in a group. Research also suggests that individuals are less critical and less creative in groups.

Participants answered state self-esteem items before and after peer evaluations. Meaning subjects acted as their own controls.  
  
Piaget’s cognitive developmental stages   
Formal operational stage: 12 years + individuals acquire abstract reasoning skills.   
  
Erikson’s psychosocial development  
infants between 3 – 7 months old are faced with issues of trust vs mistrust.   
  
Freud   
infants between 3- 7 months old are in the oral stage until ~ 12- 18 months old.   
  
Groupthink occurs when situational pressures hinder groups from critically evaluating relevant information. A powerful leader makes groupthink more likely, and the other group members are largely complicit in the behaviors and beliefs that produce groupthink. Groups affected by groupthink wrongly believe they have followed a sound decision-making process.  
As with a group affected by groupthink, an individual’s confirmation bias causes the person to seek, and attend to, only information that confirms his or her existing point of view and to ignore disconfirming evidence.  
  
Vocabulary skills tend to be lateralized to the left hemisphere, whereas visuospatial skills, music perception, and emotion processing tend to be lateralized to the right hemisphere.  
  
When people study new material, any new information introduced between the initial learning (i.e., encoding) and retrieval, such as viewing a movie, will interfere with memory consolidation

Emotional intelligence refers to the ability to perceive, express, understand, and manage one’s emotions. Emotionally intelligent people are self-aware and can delay gratification in pursuit of long-term rewards, rather than being overtaken by immediate impulses.  
  
The conditioned stimulus is a stimulus that, only after being paired several times with an unconditioned stimulus (in this case, foot shock), triggers a conditioned response (freezing behavior).

In the acquisition phase of the fear conditioning paradigm, a stimulus (light) that is neutral with respect to the freezing response is associated with an unconditioned stimulus (in this case, foot shock) over a series of trials, until the neutral stimulus elicits a conditioned response (freezing behavior in response to the light).

Subjects were administered either saline or the acetylcholine agonist, encenicline. Thus, these substances were the two levels of the independent variable.

CBT addresses smoking behaviors through:

CBT first addresses maladaptive behaviors through behavior therapy to systematically modify a person’s behavior. This is followed by sessions designed to foster cognitive change, through self-assessments.

Medicalization of smoking and smoking cessation?  
Smoking is an addictive behavior that can be treated via the use of pharmaceutical intervention.  
Medicalization refers to the taken-for-granted process in which a problem comes to be defined and treated by the social institution of medicine. A behavior undergoes medicalization when both the definition of the problem and the therapy intended to improve it are couched in medical terms.  
  
Results from a study indicate that there is a –0.82 correlation between alcohol consumption and internal locus of control.

 The strong negative correlation means that, as one variable increases (in this case, people who drink more alcohol), there is an associated decrease in another variable (in this case, internal locus of control, or believing that they control their own fate).

. The Hawthorne effect describes changes in research participants as a result of their awareness that they are being observed. The changes to the students’ study habits are best explained by the Hawthorne effect, which was first observed among workers.

A self-fulfilling prophecy is an individual’s internalization of a label that leads to a fulfillment of that label.   
  
Impression management refers to individuals actively managing how they are perceived by others.   
  
The Thomas theorem states that if an individual believes something to be real, then it is real in its consequences.