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QUESTION 1

Aerobic respiration is the major process used by oxygen- requiring organisms to generate energy. During respiration, glucose is metabolized to generate chemical energy in the form of ATP:

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 36ATP$$

The biochemical machinery necessary for cellular respiration is found in the mitochondria, small organelles scattered throughout the cytoplasm of most eukaryotic cells. The number of mitochondria per cell varies by tissue type and cell

function.

Mitochondria are unusual in that they have their own genetic systems that are entirely separate from the cell\\\'s genetic material. However, mitochondrial replication is still dependent upon the cell\\\'s nuclear DNA to encode essential proteins

required for replication. Despite this fact, mitochondria seem to replicate randomly, out of phase with both the cell cycle and other mitochondria.

The nature of the mitochondrial genome and protein synthesizing machinery has led many researchers to postulate that mitochondria may have arisen as the result of the ingestion of a bacterium by a primitive cell millions of years ago. It is

postulated that the two may have entered into a symbiotic relationship and eventually became dependent on each another; the cell sustained the bacterium, while the bacterium provided energy for the cell. Gradually, the two evolved into the

present-day eukaryotic cell, with the mitochondrion retaining some of its own DNA. This is known as the endosymbiotic hypothesis. Because mitochondrial DNA is inherited in a non-Mendelian fashion (mitochondria are inherited from the

maternal parent, who supplies most of the cytoplasm to the fertilized egg), it has been used to look at evolutionary relationships among different organisms.

A mating type of a wild-type strain of the algae C. reinhardii is crossed with the opposite mating type of a mutant strain of the algae, which has lost all mitochondrial functions due to deletions in their mitochondrial genome. All of the offspring

from this cross also lack mitochondrial functions. Based on information in the passage, this can best be explained by the:

A. endosymbiotic hypothesis.

B. non-Mendelian inheritance of mitochondrial DNA.

C. recombination of mitochondrial DNA during organelle replication.

D. presence of genetic material in the mitochondria that is distinct from nuclear DNA.

Correct Answer: B

In this question you are presented with a cross between two strains of the algae C. reinhardii. You do not need to know anything about this species of algae to answer the question. From the question stem you know that the mating type of a wild-type strain, which has normal mitochondrial DNA, is crossed with the opposite mating type of a strain that lacks functional mitochondria due to deletions in the mitochondrial genome. This whole thing about "mating types" is another way of saying male and female in species that do not technically have opposite genders, such as algae and yeast. In

addition, you\'re told that the offspring of this cross do not have functional mito- chondria either. What does this mean? Somehow the offspring have the same deleted mitochondrial genome as the mutant strain. Now all you have to do is find the choice that best accounts for this occurrence. Choice A is incorrect because the endosymbiotic theory attempts to explain the derivation of mitochondria in eukaryotic cells, not the inheritance of mitochondria. Choice B is correct. Since you\'re told that the offspring lack mitochondrial functions, this implies that they inherited their mitochondria from the mutant strain mating type. In other words, the mutant strain was the organelle-donating parent -- the female -- in this cross. Therefore, the non-Mendelian inheritance pattern of mitochondria, as explained in the passage, best accounts for these experimental observations. If the mating type of the wild-type strain had been the organelle-donating parent, then all of the offspring would have normal mitochondrial function. Choice C is wrong because the word recombination implies the formation of new gene combinations due to crossing over events that occur during reproduction. If recombinations did occur, you would expect some of the offspring to regain mitochondrial functions since wild-type mitochondrial DNA would replace the deleted segments of DNA in some offspring. Although choice D is a true statement, it does not explain the inheritance patterns observed in this cross, thus choice D is incorrect.

QUESTION 2

The anthropomorphic bias of those who would relegate marsupials to an inferior evolutionary status is most apparent in their recourse to data on brain structure and behavior. Unlike humans and other placentals, marsupials lack the corpus callosum, which facilitates inter-hemisphere transfer of data acquired through the senses. Yet it cannot be inferred that marsupials are thus deprived of such function. Didelphis Virginiana, one of the opossums, makes use of the anterior commissure, an adaptation that is also found in reptiles and monotremes. Diprodontons, including kangaroos and koalas, supplement the anterior commissure with the fasciculus aberrans. While the modes of neocortical interconnection may be diverse, the work of Johnson, Heath and Jones points to the conclusion that, functionally speaking the cortices and neocortices of both groups of mammals exhibit parallel connections. Parker also notes "a similar range of brain size to body weight ratios and of neocortical expansion". Another stigma borne by marsupials is the consensus that they are less intelligent than placentals. Yet Williams argues that, all else being equal, natural selection will favor instinctive over learned behavior as being more biologically efficient and that it is the accidental death of the young that is the prime selective pressure for the evolution of intelligence. Seen in this light, marsupials have a competitive edge; their gestation period is brief and the young remain in the pouch for an extended period exposed only to those dangers which also affect the mother. There they are directly exposed to the mother\'s food supply and can observe her behavior at leisure. Placentals, on the other hand, not only have a longer gestation period but, once their young are born, must often leave while foraging. Such absences increase the risk of mortality and decrease the opportunity to learn. Thus, among placentals, selection would favor the apparent intelligence in the young and protective behavior in the mother. Marsupials are not known to exhibit maternal protective behavior. In fact, Serventy has reported that frightened female kangaroos will drop their pouch-young as they flee, drawing a predator\'s attention to the less able offspring while the adult escapes. This behavior, whether purposeful or accidental, instantaneously relieves the female marsupial of the mechanical difficulties of pregnancy with which her placental counterpart would be burdened, while marsupials can replace any lost young quickly. Thus, in the absence of any need for close maternal supervision, sacrificing their offspring in this manner may well have been favored in selection. Pointing to the absence of the "virtue" of maternal protectiveness in marsupials is an instance of how mistaken are those theorists who see similarities with humans as marks of evolutionary sophistication.

According to the passage, which of the following favor(s) the development of intelligence as a trait of placental mammals?

I. The need to leave their young while foraging

II. The comparatively great risk of accidental death of the young

III.

 The opportunity for the young to observe the mother at leisure

A.

B.

I only

C.

III only

D.

I and II only

E.

II and III only

Correct Answer: C

This is a Roman numeral question, and the information we need to answer it is contained in the second paragraph. The last three sentences of that paragraph contain the most important information for our purposes. There we are told that the placentals need to leave their young to go foraging; that immediately justifies statement I. We\'re told directly thereafter that this absence increases the risk of accidental death to the young. Hence, we can justify statement II as well. Note: At this point, only choice C meets our needs, but don\'t ignore statement III! Statement III, on the other hand, applies only to marsupials. We are told that the absence of the mother while she forages decreases the opportunity for placentals to learn by observing the mother. Therefore, statement III is not true.Kaplan Strategy:Use "+" and "? symbols to annotate true statements and false statements, respectively, on roman numeral questions. This will guide you to the correct answer choice more quickly and will also prevent you from having to read the question over and over again.

QUESTION 3

Which disease is caused by protein misfolding, which causes plaque accumulation in the brain?

A. Alzheimer\'s disease

B. schizophrenia

C. Parkinson\'s disease

D. depression

Correct Answer: A

In Alzheimer\'s disease, misfolding of amyloid beta protein and tau protein causes deposits to form around neurons in the brain.

QUESTION 4

It is critical for the human body blood to maintain its pH at approximately 7.4. Decreased or increased blood pH are called acidosis and alkalosis respectively; both are serious metabolic problems that can cause death. The table below lists the major buffers found in the blood and/or kidneys. Table 1 Buffer pKa of a typical conjugate acid:*

$$HCO_3^- \rightleftharpoons CO_2$$
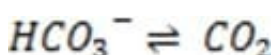
+ Histidine side chains

$$HPO_4^{2-}$$

$$\rightleftharpoons H_2PO_4^-$$
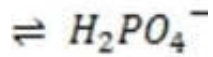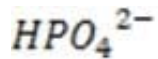
Organic phosphates N-terminal amino groups

$$\rightleftharpoons NH_4^+$$

$$NH_3$$

6.1

6.3

6.8

7.0

8.0

9.2

$$pK_a$$
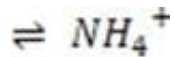
*For buffers in many of these categories, there is a range of actual values.

$$pK_a$$

The relationship between blood pH and the of any buffer can be described by the Henderson-Hasselbalch equation:

$$pK_a$$

pH = + log([conjugate base]/[conjugate acid]) Equation 1

$$CO_2$$

Bicarbonate, the most important buffer in the plasma, enters the blood in the form of carbon dioxide, a byproduct of metabolism, and leaves in two forms: exhaled and excreted bicarbonate. Blood pH can be adjusted rapidly by changes

$$CO_2$$

in the rate of exhalation. The reaction given below, which is catalyzed by carbonic anhydrase in the erythrocytes, describes how bicarbonate and interact in the blood.

CO_2

+ + Reaction 1

How does the titration of a weak monoprotic acid with a strong base differ from the titration of a strong monoprotic acid with a strong base?

A. The equivalence point will occur at a higher pH.

B. The equivalence point will occur at a lower pH.

C. The equivalence point will occur at the same pH.

D. Whether the equivalence point is higher or lower depends on the particular monoprotic acids used.

Correct Answer: A

When a weak acid is reacted with a strong base, the equivalence point will be in the basic region. Consider the titration of equimolar solutions of acetic acid and NaOH. Before the equivalence point, the following reaction takes place:

$$HC_2H_3O_2(aq) + OH^-(aq) \rightarrow H_2O + C_2H_3O_2^-(aq)$$
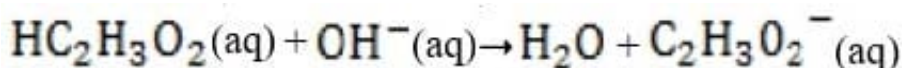
At the equivalence point, only C2H3O2?exists. When C2H3O2?undergoes hydrolysis (i.e., reacts with water), hydroxide ions are formed according to the following equilibrium:

$$C_2H_3O_2^-(aq) + H_2O \rightleftharpoons HC_2H_3O_2(aq) + OH^-(aq)$$
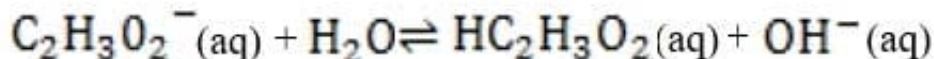
The numerical value of the equilibrium constant along with the initial concentration of acetate is all that is needed to determine the hydroxide ion concentration. When equimolar solutions of a strong acid and a strong base are titrated, the equivalence point will be neutral. It is neutral because neither of the ions present at the equivalence point can undergo hydrolysis. Choice A is therefore the correct response. Choice B would be correct if a weak base was titrated with a strong acid.

QUESTION 5

Which of these is not a female sex hormone?

A. gastrin

B. follicle stimulating hormone

C. progesterone

D. estrogen

Correct Answer: A

Gastrin is a hormone that stimulates the secretion of gastric acid in the stomach.

QUESTION 6

The equation of state of an ideal gas is given by the ideal gas law:

PV = nRT

where P is the pressure, V is the volume, n is the number of moles of gas, R is the ideal gas constant, and T is the temperature of the gas. The gas particles in a container are constantly moving at various speeds. These speeds are

characterized by the Maxwell shown in the figure below.
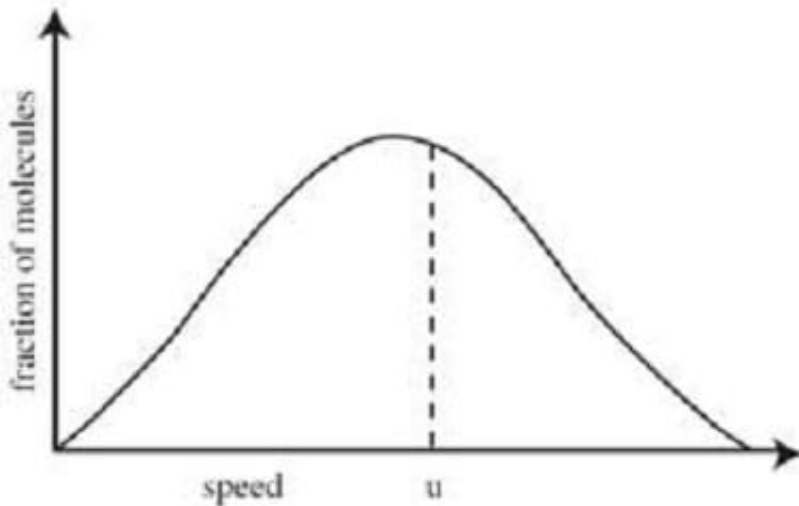
If two particles collide, their velocities change. However, if the gas is in thermal equilibrium, the velocity distribution of the gas as a whole will remain unchanged by the collision. The average kinetic energy (E) of a gas particle is given by:

$$E = \left(\frac{1}{2}\right) mu^2$$

Equation 1

where m is the mass of one particle and u is the root mean square speed (rms speed) of the gas particles: where N is the number of gas particles;

$$(i.e., u = [(v_1^2 + v_2^2 + \cdots v_n^2 / N]^{\frac{1}{2}},$$

this is different from the average speed). For an ideal gas, the kinetic energy of all the particles is:

$$E_{total} = \frac{3}{2} nRT$$

Equation 2

where n is the number of moles of gas. Combining these equations gives:

$$u = (3RT/M)^{\frac{1}{2}}$$

Equation 3

where M is the molar mass of the gas particles.

The average distance a particle travels between collisions is known as the mean free path l. Intuitively, the mean free path (mfp) could be expected to be larger for gases at low pressure, since there is a lot of space between particles.

Similarly, the mfp should be larger when the gas particles are small. The following expression for the mfp shows this to be correct.

$$l = \frac{\dot{k}T}{\sqrt{2\pi s^2 P}}$$

Equation 4 In this equation, s is the atomic diameter (typically on the order of 10?), k is the Boltzmann constant, and P is the pressure. In addition to colliding with one another, gas particles also collide with the walls of their container. If the container wall has a pinhole that is small compared to the mfp of the gas, and a pressure differential exists across the wall, the particles will effuse (or escape) through this pinhole without disturbing the Maxwellian distribution of the particles. The rate of effusion can be described by:

$$\frac{\Delta n_{eff}}{\Delta t} = \frac{A(P - P^1)}{\sqrt{2\pi MRT}}$$

Equation 5

Where neff is the number of moles of effusing particles, A is the area of the pinhole, p and p1 are the pressures on the inside and outside of the container wall respectively, and p>p1.

The mean free path of a gas will be longer if the :

A. pressure of the gas is increased.

B. number of gas particles per unit volume is increased.

C. distance between collisions is decreased.

D. pressure of the gas is decreased.

Correct Answer: D

The mean free path of a particle is the average distance the particle can travel before it collides with another gas particle or the wall of the container. The longer the distance that a gas particle travels between collisions, the further apart the individual gas molecules must be. That means that the volume of the gas must increase to increase the distance between collisions. One way to increase the volume is to decrease the pressure of the gas, so D is correct. Choice A is incorrect because an increase in pressure leads to a decrease in the volume and thus a decrease in mean free path as well. Thus the gas particles are closer together and are more likely to collide, decreasing the average distance they travel between collisions. Choice B is incorrect because if the number of particles is increased while the volume remains constant, the likelihood of a collision will also increase. The pressure also increases as the number of particles per unit

volume increases. Choice C is incorrect because the mean free path is analogous to the distance between collisions and if this is decreased then the mean free path decreases s well. Basically, choices A, B and C will all decrease the mean free path of a gas, making them all incorrect.

QUESTION 7

The time has come to acknowledge the ascendancy of the humanistic psychology movement. The so- called "Third Stream" emerged at mid-century, asserting itself against the opposition of a pair of mighty, long-established currents, psychoanalysis and behaviorism. The hostility between these two older schools, as well as divisiveness within each of them, probably helped enable humanistic psychology to survive its early years. But the movement flourished because of its wealth of insights into the nature of this most inexact science.

Of the three major movements in the course of 20th century psychology, psychoanalysis is the oldest and most introspective. Conceived by Sigmund Freud as a means of treating mental and emotional disorders, psychoanalysis is based on the theory that people experience unresolved emotional conflicts in infancy and early childhood. Years later, although these experiences have largely disappeared from conscious awareness, they may continue to impair a person\\'s ability to function in daily life. The patient experiences improvement when the psychoanalyst eventually unlocks these long-repressed memories of conflict and brings them to the patient\\'s conscious awareness.

In the heyday of behaviorism, which occurred between the two world wars, the psychoanalytic movement was heavily criticized for being too concerned with inner subjective experience. Behavioral psychologists, dismissing ideas and feelings as unscientific, tried to deal only with observable and quantifiable facts. They perceived the human being merely as an organism which generated responses to stimuli produced by its body and the environment around it. Patients\\' neuroses no longer needed analysis; they could instead by modified by behavioral conditioning. Not even babies were safe: B.F. Skinner devised a container in which infants could be raised under "ideal" conditions -- if a sound-proof box can be considered the ideal environment for child-rearing.

By mid-century, a number of psychologists had grown dissatisfied with both the deterministic Freudian perspective and the mechanistic approach of behaviorism. They questioned the idea that human personality becomes permanently fixed in the first few years of life. They wondered if the purpose of psychology was really to reduce people to laboratory specimens. Was it not instead possible that human beings are greater than the sum of their parts? That psychology should speak to their search for fulfillment and meaning in life?

It is questions like these that members of the Third Stream have sought to address. While the movement cannot be simplified down to a single theoretical position, it does spring from certain fundamental propositions. Humanistic psychologists believe that conscious experience, rather than outward behavior, is the proper subject of psychology. We recognize that each human being is unique, capable of change and personal growth. We see maturity as a process dependent on the establishment of a set of values and the development of self. And we believe that the more aspects of self which are satisfactorily developed, the more positive the individual\\'s self-image.

Abraham Maslow, a pioneer of the Third Stream, articulated a hierarchy of basic human needs, starting with food, water and air, progressing upward through shelter and security, social acceptance and belonging, to love, esteem and self-expression. Progress toward the higher stages cannot occur until all of the more basic needs have been satisfied. Individuals atop the pyramid, having developed their potential to the highest possible extent, are said to be "self-actualized".

If this humanist theoretical perspective is aimed at empowering the individual, so too are the movement\\'s efforts in the practical realm of clinical psychology. Believing that traditional psychotherapists tend to lead patients toward predetermined resolutions of their problems, Carl Rogers pressed for objective evaluations of both the process and outcome of psychotherapeutic treatment. Not content to function simply as a reformer, Rogers also pioneered the development of "client-centered" or nondirective therapy, which emphasizes the autonomy of the client (i.e., patient). In client-centered therapy, clients choose the subjects for discussion, and are encouraged to create their own solutions to their problems.

A. F. Skinner is mentioned in the passage to support the point that:

B. the ultimate goal of behaviorism is technological innovation.

C. raising babies in isolation prevents childhood conflicts.

D. stimulus-response conditioning was attempted on all sorts of individuals.

E. behaviorists reject the scientific validity of subjective experience.

Correct Answer: C

This asks why B.F. Skinner is mentioned in the passage. This issue was already addressed during the explanations for

QUESTION 8

A teacher sets up a reward system for her elementary school students. At the end of each day, she gives a sticker to each student who showed up on time that morning. At the end of each week, she gives a sticker to any student who got above a 90% on three quizzes in a row. After months of this regimen, she finds that performance on the quizzes has increased significantly but that tardiness has only decreased slightly.

Which of the following best explains the teacher\'s observation?

A. Variable ratio schedules create the strongest responses and behavior that is the least susceptible to extinction.

B. The students had more intrinsic motivation to do well on quizzes than to show up on time.

C. The students\' behavior change was stronger in response to a fixed-ratio schedule than it was to a continuous reinforcement schedule.

D. The students\' behavior change was stronger in response to a fixed-ratio schedule than it was to a variable-interval schedule.

Correct Answer: C

The teacher was offering rewards on two schedules. Showing up on time was always rewarded with a sticker. Rewarding for each instance of behavior is a continuous reinforcement schedule. She then also rewarded good quiz performance for every three quizzes. This was a fixed-ratio schedule. The teacher observed that the quiz performance increased more than the timeliness did, so the students were responding more strongly to the fixed-ratio schedule. Thus, choice (C) is correct.

A: While this is true, the teacher wasn\'t using a variable-ratio schedule.

B: Intrinsic motivation is irrelevant to this scenario ?all the motivation discussed is extrinsic.

D: The teacher didn\'t use a variable-interval schedule.

QUESTION 9

Which of following is mostly likely the result of large scale destruction of forests?

A. Increase in air humidity

B. Decrease in floods

C. Increase in soil erosion

D. Decrease in carbon dioxide

Correct Answer: C

QUESTION 10

Which of the following is NOT a commonly occurring sulfur compound?

A. H_2SO_4

B. H_2S

C. SO_3

D. SO_2

Correct Answer: C

QUESTION 11

By now the image of California in decline looms as large in the conventional media wisdom as the Golden State -- triumphant clich? of a generation ago -- "this El Dorado," as Time magazine had put it in 1969, that was to be "the mirror of America as it will become." Hardly anyone mentions the sunshine these days, or the beaches, or the beautiful young families around the pool, or the new lifestyles that all Americans will soon emulate, or how the University of California is wall-to-wall with cyclotrons and Nobel laureates, or how the state\\'s higher-education system is accommodating absolutely all comers at little or no cost.

Today, California classrooms are among the most crowded in the country; many schools operate without libraries, without counselors, without nurses, without art or music, with greatly diminished curricular offerings. And what\\'s true for the schools is true for the other services that have no powerful constituencies: children\\'s protective services, probation, public health. Many cities have shut down swimming and wading pools because they cannot be safely maintained, and fenced playgrounds have been shut because of the danger presented by cracked and splintered structures. The list could be extended indefinitely. As thousands of professors receive golden handshakes from the University of California and California State University, among them some of the stars recruited in the go- go Fifties, the crowding in the lecture halls has increased and the lines at the classroom door have gotten longer and longer ("Don\\'t panic," says the T-shirt on a student waiting to enroll at a Sacramento junior college, but many have been in line since four in the morning). U.C. tuition, which was roughly $800 a year in the early 1980s, is now over $4,000, a figure not out of line with tuitions at public colleges in other states but a far cry from the cost of a California state education in the golden days -- and it is almost certain to increase again next year. More than 200,000 students -- roughly 10 percent -- have vanished from the rolls of the state\\'s colleges and universities in the past two years. While per capita tax revenues have been effectively frozen, and while they have declined relative to other states, client rolls for state services -- schools, prisons, Medicaid, welfare -- have been rising faster than population, leaving a structural gap that no one has yet confronted, much less closed. Again this year, the governor and legislature borrowed $7 billion from the banks and rolled over a $5 billion budget deficit, for which few politicians have proposed any remedies. Thanks to the deficit, California, which a decade ago, had one of the highest bond ratings in the country, has one of the lowest. "Were California a corporation," said John Vasconcellos, the chairman of the State Assembly Ways and Means Committee, "it would have little option but to initiate some sort of bankruptcy proceeding." The new image of California is familiar enough: a state suffering from earthquakes, fires, drought, floods, urban riots, dirty air, schools as overcrowded as the freeways; a legislature -- once said to be the nation\\'s most professional and progressive -- oozing with corruption and stuck in the budgetary gridlock; and of course, recession, unemployment, chronic budget deficits, and financial calamity. For those who know their Nathaniel West, their Raymond Chandler, and their Joan Didion, the California apocalypse imagery is hardly new; it was

always there on the dark side of the dream. This was the place, as Didion wrote back in the 1960s, "in which a boom mentality and a sense of Chekhovian loss meet in uneasy suspension; in which the mind is troubled by some buried but ineradicable suspicion that things better work here, because here, beneath that immense bleached sky, is where we run out of continent." os Angeles has burnt before. If you believe people like Governor Wilson, most of the state\\'s problems were created somewhere else, usually in Washington, where the Clinton Administration has, on the one hand, cost California hundreds of thousands of jobs through excessive defense cuts and, on the other, allowed a horde of illegal immigrants to overrun the state\\'s schools and health facilities without paying them for the immense costs that come with them...much has been changed in California since the days of West and Chandler, but the capacity for denial and self-deception is undiminished. In fact, California\\'s trouble is at once more prosaic and more complex than the political rhetoric claims or the apocalyptic imagery suggests. It began before the recent recession, the big 1991 fire in the Oakland hills or the San Francisco earthquake of 1989 (itself a rerun of a classic), before those L.A. cops beat up Rodney King or the riot and the fire that followed their acquittal in the first trial, before the eight-year drought that still may not be over. And contrary to what a lot of Californians believe, a lot of the damage didn\\'t just happen to us: we inflicted it on ourselves.

It can be inferred from the passage that compared to other states, California:

A. had held one of the highest bond ratings.

B. continues to make public education affordable to its residents.

C. has a progressive and professional legislature.

D. has been successful in balancing budgets.

Correct Answer: A

Choice A is supported by line 47, which states that California had one of the highest bond ratings in the country.

Choice B can be deduced from information presented in paragraph three. The passage describes increases in tuition and then details the decreases in the numbers of enrolled students. Although California did have a professional legislature

at one point, the present California legislature is "oozing with corruption" (line 56).

Choice D is clearly wrong as indicated in paragraph four.

QUESTION 12

The reaction below is NOT spontaneous at any temperature.

2ICl(g) I2(g) + Cl2(g)
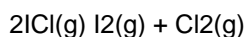
Which of the following is true?

A. $\Delta H > 0, \Delta S > 0$
B. $\Delta H > 0, \Delta S < 0$
C. $\Delta H < 0, \Delta S > 0$
D. $\Delta H < 0, \Delta S < 0$

A. Option A

B. Option B

C. Option C

D. Option D

Correct Answer: B

The relationship between G , H, S, and temperature is G = H ?TS For a reaction to be spontaneous, G must be less than zero. If a reaction is not spontaneous at any temperature, H must be positive and S must be negative. No matter what the temperature, G will always be positive and the reaction will be nonspontaneous. Choice B is therefore the correct response. Choice A is for a reaction that would be spontaneous if the temperature was sufficiently high. Choice C is for a reaction that is spontaneous at ALL temperatures. Choice D is for a reaction that would be spontaneous if the temperature was sufficiently low.

QUESTION 13

The endosymbiosis theory proposes that mitochondria originated through the engulfing of aerobic prokaryotes by anaerobic host prokaryotes. Many of the enzymes required for aerobic respiration are located on the inner membrane of the

mitochondria. Where would these enzymes, or their precursors, most likely have been found three billion years ago (prior to endosymbiosis)?

A. In the cytoplasm of the anaerobic prokaryotic host cells

B. On the plasma membrane of the anaerobic prokaryotic host cells

C. On the plasma membrane of the aerobic prokaryotic engulfed cells

D. In the cytoplasm of the prokaryotic aerobic cells

Correct Answer: C

Explanation: As the host cell engulfs a prokaryotic aerobic cell, the host cell membrane forms a vesicle about the aerobic cell, giving a double membrane structure. The inner membrane is formed bythe plasma membrane of the aerobic cell.

Choice A is incorrect because enzymes in the cytoplasm of the anaerobic host cell would remain in the cytoplasm.

Choice B is incorrect because enzymes on the plasma membrane of the anaerobic host cell would befound on the outer membrane of the mitochondria formed by endosymbiosis. Choice D is incorrect because enzymes in the cytoplasm of

the aerobic cell would be within the matrix of the mitochondria formed by endosymbiosis.

QUESTION 14

One distinguishing factor in a redox titration, as opposed to other titrations, is that it involves:

A. the determining of an unknown concentration in one reactant.

B. the quantitative analysis of a substance.

C. the use of a known concentration.

D. the use of oxidation and reduction.

Correct Answer: D

This is the only answer choice that is unique to a redox titration. The other choices are common to various types of titrations.

QUESTION 15

The nuclei of certain unstable isotopes will spontaneously decay, producing a more stable nucleus and releasing a particle or quantity of energy. Alpha decay releases a helium nucleus, beta decay emits an electron, while gamma decay is the emission of a high energy photon. Each type of radioactive decay is characterized, in part, by the half-life of the radioactive material--the time required for half of the nuclei in a sample to undergo decay. Examples of such decays are shown in Figure 1.

$$\text{alpha decay} \quad {}^{238}_{92}\text{U} \longrightarrow {}^{234}_{90}\text{Th} + {}^{4}_{2}\alpha$$

$$\text{beta decay} \quad {}^{60}_{27}\text{Co} \longrightarrow {}^{60}_{28}\text{Th} + {}^{0}_{-1}\beta$$

$$\text{gamma decay} \quad {}^{64}_{28}\text{Ni}^{*} \longrightarrow {}^{64}_{28}\text{Ni} + \gamma$$
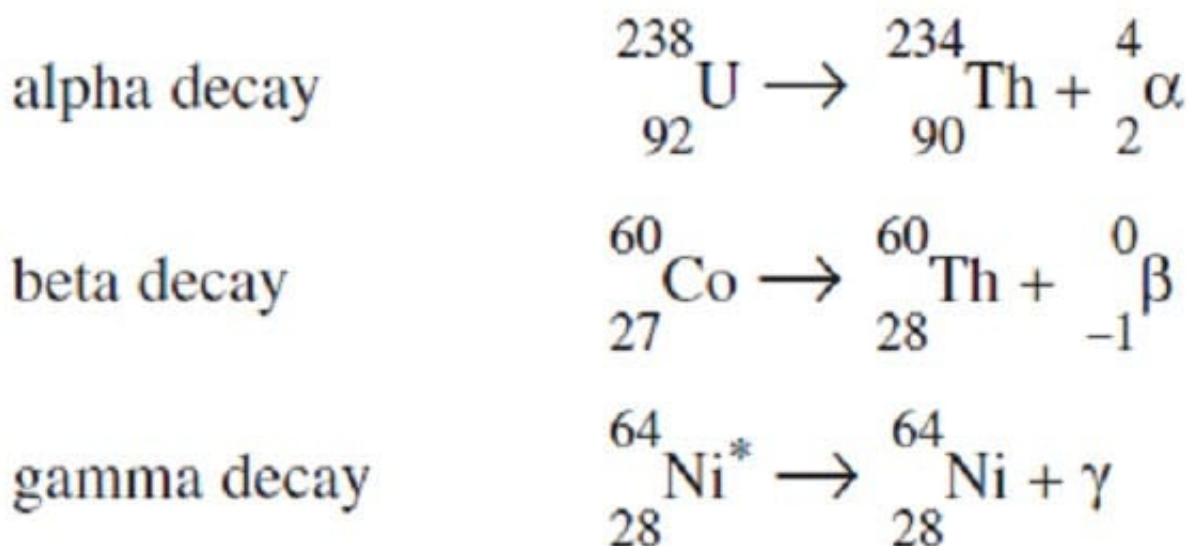
Figure 1

A Geiger counter can be used to detect the decay of radioactive materials. A simple Geiger counter consists of a hollow metal cylinder with a wire along its axis. The cylinder is filled with low pressure argon gas and a high voltage difference is

applied between the wire and the cylinder. When alpha, beta, or gamma radiation passes through the cylinder, it interacts with the gas particles and leads to the formation of ions which cause a discharge between the wire and the cylinder.

The consequent current may be used to drive a speaker, producing the characteristic clicking sound of the Geiger counter each time a pulse of current occurs. The Geiger counter circuitry is shown in Figure 2.
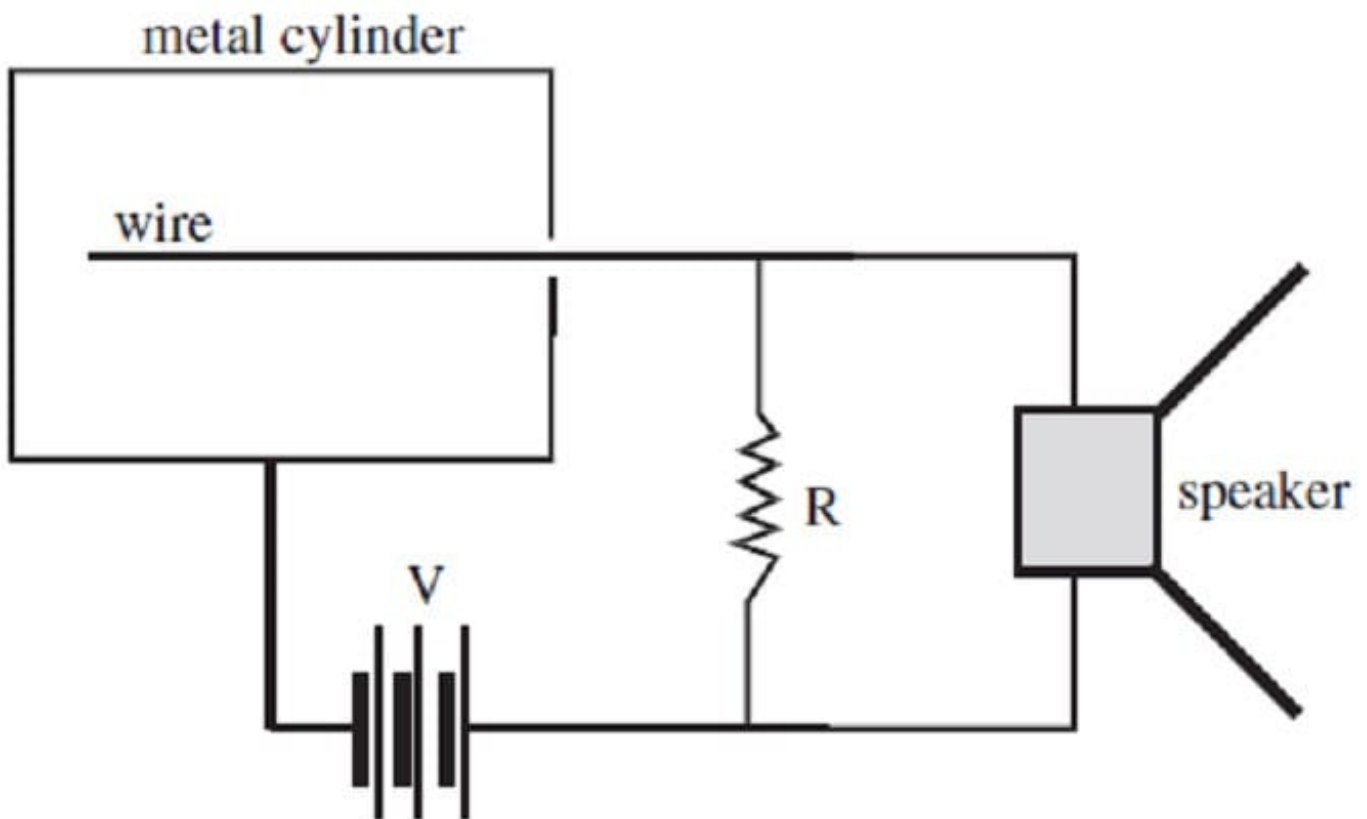
Figure 2

A Geiger counter is best suited for which of the following applications:

A. comparing the relative magnitudes of radioactivities of two nuclear waste depositories.

B. spatially locating a radioactive isotope injected into a patient.

C. calculating the total energy of a radioactive particle.

D. determining the identity of various types of radioactivity.

Correct Answer: A

A Geiger counter provides a largely qualitative measure of radioactivity in an area.Choice B is incorrect because a Geiger counter cannot locate radioactivity with the precision required for a radioimmuno assay.Choice C is incorrect because a

Geiger counter does not provide a quantitative measure of the energy of a particle. If the particle has enough energy to produce an ionization, it will produce a click. Any energy beyond this is not detected.

Choice D is incorrect because a Geiger counter cannot differentiate between different types of ionizing radiation.

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