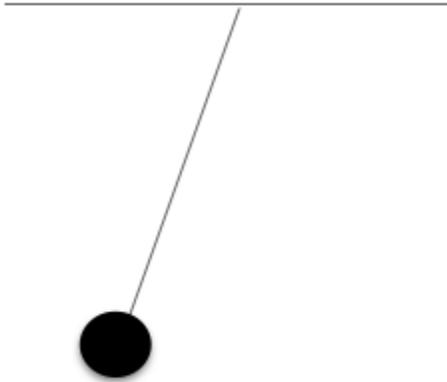


ACT SCIENCE PRACTICE PAPER

QUESTION: 1

Laura is performing an experiment with a 5kg weight tied to a 3m rope tied to the ceiling as shown:



Laura drops the weight and allows it to swing freely. She measures how long it takes for the weight to return to its original position (assume no forces outside of gravity are acting upon the pendulum). This is also called one oscillation.

Experiment 1:

Laura created the following table for her first measurement of the pendulum's oscillations.

Number of oscillations	1	2	3
Length of time	3.474	6.949	10.424

Experiment 2:

Laura performed the experiment again, this time using a 6kg weight.

Number of oscillations	1	2	3
Length of time	3.474	6.949	10.424

Experiment 3:

Laura performed the experiment again, this time using a 3kg weight and a 5m rope.

Number of oscillations	1	2	3
Length of time	4.486	8.972	13.457

1. If Laura created a new experiment (experiment 4) and used a 3kg mass and a 6m rope, how long would one oscillation likely be?

4.914

4.486

4.2

10.123

QUESTION: 2

The significant increase in atmospheric carbon dioxide since pre-industrial levels can be seen in the world's oceans which absorb the CO_2 and in turn undergo changes in chemistry. The consequences of increased CO_2 include acidification of seawater and a decrease in carbonate ion (CO_3^{2-}) concentration.

Changes in seawater chemistry affect marine organisms. The early life stages of invertebrates, such as squid, may be particularly vulnerable to changes in carbon dioxide levels. Acting as both predator and prey, squid are a significant component of marine ecosystems. For example, fish and sea birds, such as tuna and albatross, are dependent on squid as a source of prey. Furthermore, the fishing industry is impacted by the health of squid populations. California fisheries produce the majority of market squid.

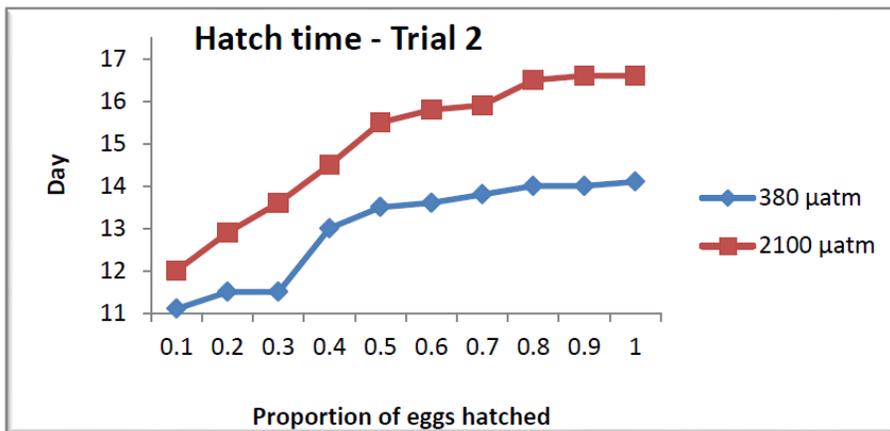
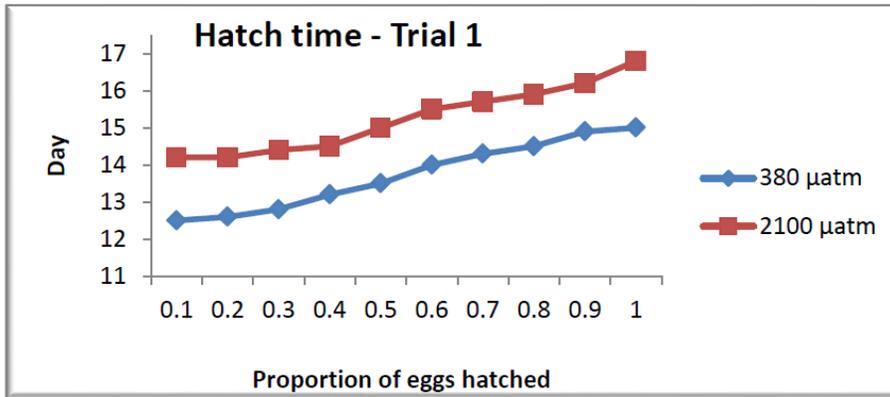
In order to determine how increased levels of carbon dioxide affect the development of squid, eggs were hatched in two different conditions: normal (380 μatm) and elevated (2100 μatm) levels of CO_2 . The time to hatch and the size of the larval mantle (the anatomical feature that includes the body wall and fins) were measured and recorded. Two trials were conducted for each carbon dioxide concentration.

	CO ₂ concentration	Temperature	pH	Salinity
Trial 1	380 µatm	20.35	7.89	30.518
Trial 2	380 µatm	20.26	7.84	30.600
Trial 1	2100 µatm	20.28	7.29	30.450
Trial 2	2100 µatm	20.33	7.31	30.724

Water chemistry conditions for each trial

	CO ₂ concentration	Length (mm)
Trial 1	380 µatm	1.88
Trial 2	380 µatm	1.91
Trial 1	2100 µatm	1.67
Trial 2	2100 µatm	1.75

Average larval mantle lengths



2. The results of this experiment show that _____.

select

Higher levels of marine carbon dioxide reduce the size of tuna

select

Lower marine pH levels increase the size of squid

select

Higher levels of atmospheric carbon dioxide reduce the size of squid

select

Lower marine pH levels reduce the hatching time of squid

QUESTION: 3

Since the early 1900s, there has been a steady increase in the earth's atmospheric temperature, resulting in a phenomenon called "Global Warming." While the steady temperature change has been well documented, the cause of global warming remains controversial.

Scientist 1

Scientist 1 believes that "external forcings" are the cause of increased temperature over the past century. "External forcings" can direct the change in temperature over thousands of years. One example of an external force is variation in the earth's orbit around the sun. The earth orbital cycle lasts 26,000 years and causes general trends in warming and cooling.

Scientist 2

Scientist 2 believes that global warming is a man-made phenomenon due to an increase in greenhouse gases such as carbon dioxide or methane. Greenhouse gases have a natural warming effect, however, an increase in the amount of atmospheric greenhouse gases many enhance that effect. Since 1750, the concentration of carbon dioxide has increased 36 percent while the amount of atmospheric methane has increased 148 percent.

3. What data supports Scientist 2's theory?

select

A graph depicting a negative correlation between the concentration of greenhouse gases and average atmospheric temperature

A graph depicting a positive correlation between the number of humans on earth and the average atmospheric temperature

A graph depicting a negative correlation between the number of humans on earth and the average atmospheric temperature

A graph depicting a positive correlation between the concentration of greenhouse gases and average atmospheric temperature

QUESTION: 4

A group of scientists wanted to test the effects of Nitra-Grow, a chemical additive that can be given to plants to help them grow. 3 test groups of plants were given all the same time of sunlight, the same type of soil, and the same amount of water. Plant A was given no extra chemicals. Plant B was given 5g of Nitra-Grow. Plant C was given 5g of Ammonia to see if Nitra-Grow worked any better than a basic nitrogen-based household product. The plants are then measured on 5 consecutive days to find their average height (in cm).

DAY	Height Plant A (cm)	Height Plant B (cm)	Height Plant C (cm)
1	1.2	1.2	1.2
2	1.4	1.4	1.2
3	1.6	1.8	1.3
4	1.8	2.4	1.3
5	2.0	2.6	1.4

4. On Day 7, what would be plant A's approximate height?

2.2cm

2.0cm

An approximate answer cannot be made.

2.4cm

2.9cm

QUESTION: 5

Chemotherapy	No treatment	Surgery and Chemotherapy
2 inches	2 inches	2 inches
2.1 inches	3 inches	.05 inches
1.8 inches	5 inches	.09 inches
1.4 inches	7 inches	.05 inches
1 inch	9 inches	.03 inches

The table above shows measurements for tumor size growth over time within three different possible treatment methods. Each tumor was first documented at an initial size of 2 inches. Every month each tumor was measured, for a total of five measurements of each tumor.

5. What conclusion CANNOT be reached based on the data shown above?

All of these conclusions can be reached based on the data above.

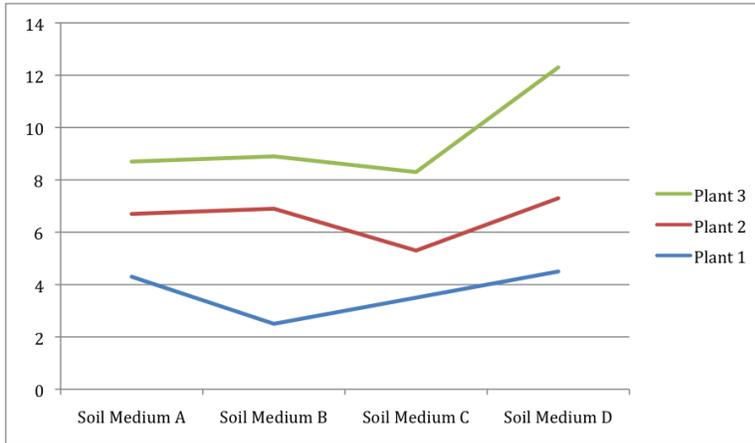
All three tumors started being observed when they were 2 inches in size.

None of these conclusions can be reached based on the data above.

Each tumor was measured 5 times.

All three tumors observed grew at the same rate.

QUESTION: 6



The chart above shows the height growth of three different plant species after a period of 2 weeks. Each plant species was grown in 4 different soil mediums. All the plants were grown in the same environment with equal amounts of light, water, and oxygen.

6. What could be added to this experiment to improve the data representation?

The chart should have a title.

The Y-axis on the chart should be labeled.

All of the options listed would improve the data representation.

The data would be better represented with "Type of Plant" on the X-axis with four points above for each growth medium.

A supplemental chart listing the soil composition breakdown for each soil medium would be helpful.

QUESTION: 7

Sleep plays a vital role in defining the daily activities of virtually all animals. During periods of sleep, the parasympathetic nervous system becomes active and induces a relaxed state in response to increased levels of the hormone melatonin. Yet, despite its ubiquity in the animal kingdom, the purpose of sleep and its role in our daily lives has been disputed by scientists. Two scientists discuss their theories about the purpose of sleep.

Scientist 1

During periods of sleep, animals are able to conserve energy that they would otherwise be spending on unnecessary activity. If an animal's primary food source is most abundant during daylight, it is a waste of precious energy to be moving about at night. For example, many herbivores, such as squirrels, are *diurnal* (sleep during the night) because their food source is available during the day, while many insectivores, such as bats, are *nocturnal* (sleep during the day) because their food source is available during the night. Food sources, as an animal's most valuable resource, dictate their sleep cycles. Many animal traits observable today evolved as a result of the supply and demand of food in their natural habitat.

Scientist 2

During waking hours, it is true that the body utilizes large amounts of energy. However, the role of sleep is to restore biological products that were utilized during periods of wakefulness, rather than simply avoid utilizing energy in the first place. Many types of biological molecules, such as hormones, are released throughout the body while an animal is active. Sleep serves as a period of inactivity during which the body can manufacture and store a supply of these molecules for future use during the next period of activity. Furthermore, sleep allows the body to repair cellular damages that has accumulated during waking hours. Experimental evidence shows that when animals are deprived of sleep, their immune system quickly weakens and death rates increase. Sleep is necessary for animals to prevent accumulation of damage and to regenerate crucial biomolecules for daily life.

7. The scientists agree on which of the following principles:

select

Animals have evolved the need for sleep based on their diet.

select

Animals use large amounts of energy while awake.

Animals will die more easily if they do not sleep.

Animals accumulate biological damage while awake.

Animals spend the most time searching for food while awake.

QUESTION: 8

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Scientist 2

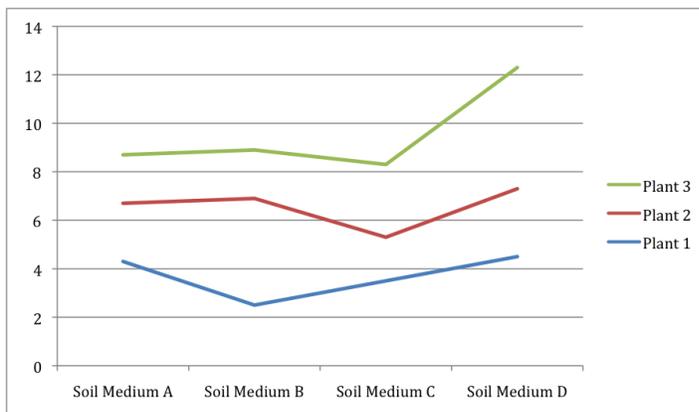
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animals are deprived of sleep, their immune system quickly weakens and death rates increase. Sleep is necessary for animals to prevent accumulation of damage and to regenerate crucial biomolecules for daily life.

8. Which of the following best describes how the scientists view the role of sleep?

- Scientist 1: conserve energy; Scientist 2: resource availability
- Scientist 1: restore the body; Scientist 2: regenerate biomolecules
- Scientist 1: conserve energy; Scientist 2: restore the body
- Scientist 1: regenerate biomolecules; Scientist 2: restore the body
- Scientist 1: eliminate wastes; Scientist 2: restore the body

QUESTION: 9



The chart above shows the height growth of three different plant species after a period of 2 weeks. Each plant species was grown in 4 different soil mediums. All the plants were grown in the same environment with equal amounts of light, water, and oxygen.

9. What factor would weaken the design of this experiment?

-

All three plants require equal amounts of oxygen and water.

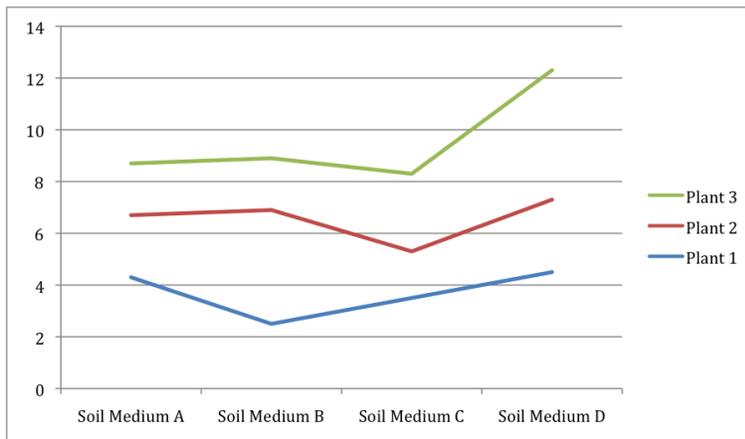
Plant 1 requires more light than Plant 2 and Plant 3 in order to reach maximum growth.

All four mediums contain different soil nutrients.

The water used by the plants had mineral levels tested through out the experiment.

Plant height growth was measured by a computer program.

QUESTION: 10



The chart above shows the height growth of three different plant species after a period of 2 weeks. Each plant species was grown in 4 different soil mediums. All the plants were grown in the same environment with equal amounts of light, water, and oxygen.

10. Based on the chart, soil Medium C has what effect on plant growth?

Soil Medium C is beneficial for Plant 1, but has negative effects on Plant 2 and Plant 3.

Soil Medium C is beneficial for all three plant types.

Soil Medium C has a negative effect on the height growth of all three plants.

Soil Medium C is beneficial for Plant 2, but detrimental for Plant 1 and Plant 3.

Soil Medium C does not seem to have a noticeable effect on Plant 1, but has a beneficial effect on Plant 2 and Plant 3.

QUESTION: 11

Dominant alleles (D) produce dominant characteristics; recessive alleles (d) produce recessive characteristics. Dominant alleles are expressed whenever present (DD, Dd) but recessive alleles are expressed only when the dominant allele is absent (dd)

A study was done in which the visual traits of two plants and their offspring was tested. In this study, Plant A, a Tall Purple plant, was mated with Plant B, a Tall Pink plant. It has been determined that the dominant trait for height is tall (H) and the dominant trait for color is purple (P).

Breeding both plants will result in offspring that have recessive and dominant traits. The chart below contains all the possibilities for their offspring.

Figure 1.

Parent A	Parent B
Tall (HH)	Tall (Hh)
Purple (Pp)	Pink (pp)

Figure 2. HH Pp x Hh pp Offspring

	HP	HP	Hp	Hp
--	----	----	----	----

Hp	HHPp	HHPp	HHpp	HHpp
Hp	HHPp	HHPp	HHpp	HHpp
hp	HhPp	HhPp	Hhpp	Hhpp
hp	HhPp	HhPp	Hhpp	Hhpp

11. Is it possible that either plant from Figure 1 had at least one short parent?

Plant A No, Plant B Yes

Plant A Yes, Plant B Yes

Plant A Yes, Plant B No

Plant A No, Plant B No

QUESTION: 12

Dominant alleles (D) produce dominant characteristics; recessive alleles (d) produce recessive characteristics. Dominant alleles are expressed whenever present (DD, Dd) but recessive alleles are expressed only when the dominant allele is absent (dd)

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Parent A	Parent B
Tall (HH)	Tall (Hh)
Purple (Pp)	Pink (pp)

Figure 2. HH Pp x Hh pp Offspring

	HP	HP	Hp	Hp
Hp	HHPp	HHPp	HHpp	HHpp
Hp	HHPp	HHPp	HHpp	HHpp
hp	HhPp	HhPp	Hhpp	Hhpp
hp	HhPp	HhPp	Hhpp	Hhpp

12. Suppose two distinct tall purple plants had offspring. What is the likelihood that their offspring will also be tall and purple?

0%

50%

100%

Not enough information given

QUESTION: 13

Chemotherapy	No treatment	Surgery and Chemotherapy
2 inches	2 inches	2 inches
2.1 inches	3 inches	.05 inches
1.8 inches	5 inches	.09 inches
1.4 inches	7 inches	.05 inches
1 inch	9 inches	.03 inches

The table above shows measurements for tumor size growth over time within three different possible treatment methods. Each tumor was first documented at an initial size of 2 inches. Every month each tumor was measured, for a total of five measurements of each tumor.

13. Looking at the "Surgery and Chemotherapy" treatment column, where could one infer that chemotherapy was performed?

0.09 inches to 0.05 inches

2 inches to 0.05 inches

0.05 to 0.03 inches

Nothing can be inferred.

0.05 to 0.09 inches

QUESTION: 14

Chemotherapy	No treatment	Surgery and Chemotherapy
2 inches	2 inches	2 inches
2.1 inches	3 inches	.05 inches
1.8 inches	5 inches	.09 inches
1.4 inches	7 inches	.05 inches
1 inch	9 inches	.03 inches

The table above shows measurements for tumor size growth over time within three different possible treatment methods. Each tumor was first documented at an initial size of 2 inches. Every month each tumor was measured, for a total of five measurements of each tumor.

14. Based on the table above, which single method is most effective at reducing tumor size in the shortest period of time?

surgery

no treatment

surgery and chemotherapy

chemotherapy

cannot be answered

QUESTION: 15

Mitochondria make 90% of the energy needed by the body to sustain life. The Mitochondrial Free Radical Theory of Aging (MFRTA) theorizes that individuals who live longest produce fewer mitochondrial oxygen reactive species than individuals that have a shorter life span. Therefore, lifespan will increase if fewer mtROS are produced, and lifespan will decrease if more mtROS are produced. An experiment was done to test this theory, and the results are shown in the chart below. Four test groups of flies were involved, two groups consisted of females, and two groups consisted of males.

	Test group 1	Test group 2	Test group 3	Test group 4
# of mtROS	3.9	2.5	3.2	2.7
Lifespan	110 days	120 days	95 days	89 days

15. What information would weaken the experiment's results?

A separate experiment done with a different test species that had similar results.

An experiment testing the lifespan of flies in an oxygen-deprived environment.

An experiment consisting of a control group of both males and females.

An experiment suggesting there is a high-percent error in measuring mitochondrial oxygen reactive species.

An experiment suggesting mitochondria make more than ninety percent of the body's energy.

QUESTION: 16

Mitochondria make 90% of the energy needed by the body to sustain life. The Mitochondrial Free Radical Theory of Aging (MFRTA) theorizes that individuals who live longest produce fewer mitochondrial oxygen reactive species than individuals that have a shorter life span. Therefore, lifespan will increase if fewer mtROS are produced, and lifespan will decrease if more mtROS are produced. An experiment was done to test this theory, and the results are shown in the chart below. Four test groups of flies were involved, two groups consisted of females, and two groups consisted of males.

	Test group 1	Test group 2	Test group 3	Test group 4
# of mtROS	3.9	2.5	3.2	2.7
Lifespan	110 days	120 days	95 days	89 days

16. What, if added, would strengthen the results of the experiment?

A test group living in an isolated environment that showed a lifespan of 100 days and a mtROS amount of three.

Two test groups consisting of a mixed male and female population that showed an overall decrease in lifespan with higher mtROS amounts.

Two test groups, one male and one female, having a genetic mitochondrial disease but a significantly long lifespan.

Two test groups consisting of a mixed male and female population that had a mtROS amount of 5 and a lifespan of 150 days.

All of the answers listed.

QUESTION: 17

Species distribution is a key component to analyze ecological systems. Species may inhabit a system in a variety of ways. Several of these types of distribution include the following: clustered, uniformed, and randomized. Clustered groupings are the most common. These species tend to inhabit areas in close packs of three or more organisms. These may consist of mating partners, packs, or families of organisms. Uniformed distribution occurs when organisms of a species inhabit a particular area that is not disrupted by organisms of the same species. This could be accomplished by pheromones, toxins, or aggressive behavior that marks an organism's territory. Last, the most uncommon species distribution is randomized distribution. This distribution rarely occurs in nature and is classified as a scattering of organisms with no discernible pattern or arrangement.

17. A species of oak tree grows in deciduous, hardwood forests. This species grows and germinates in close proximity to one another if sunlight and resources can support growing numbers. The trees are interdispersed between other hardwoods including birches and cherries. What type of distribution does this species of oak tree best represent?

Clustered

Randomized

None of the distribution choices are correct.

Uniformed

QUESTION: 18

Species competition is driven by a variety of factors. Resources such as water, food, sunlight, and suitable habitat are among the top contributors that influence interspecific and intraspecific competition. Interspecific is competition between different species and intraspecific competition is between members of the same species.

One interesting example of interspecific competition is that of two barnacle species that inhabit intertidal zones. *Balanus balanoides* inhabits the lower intertidal zone and *Chthamalus stellatus* inhabits the lower intertidal zone. A researcher attempts to study this phenomenon.

The researcher removes the *Balanus* species from the lower intertidal zone and observes that the *Chthamalus* species expands its range to inhabit the lower intertidal zone and the upper intertidal zone. The researcher then removes the *Chthamalus* species from the upper tidal zone of a different area and observes that the *Balanus* species does not extend its range. The researcher concludes that competition has allowed each species to exist simultaneously by forming specialized niches that promotes survivorship for each species.

18. An invasive predator has been introduced into the intertidal ecosystem and has begun to encroach on the barnacles' habitats. It directly competes with the *Balanus* species but cannot reproduce as quickly as the *Chthamalus* species. What is likely to happen to the *Chthamalus* population?

The population will extend to the lower intertidal region.

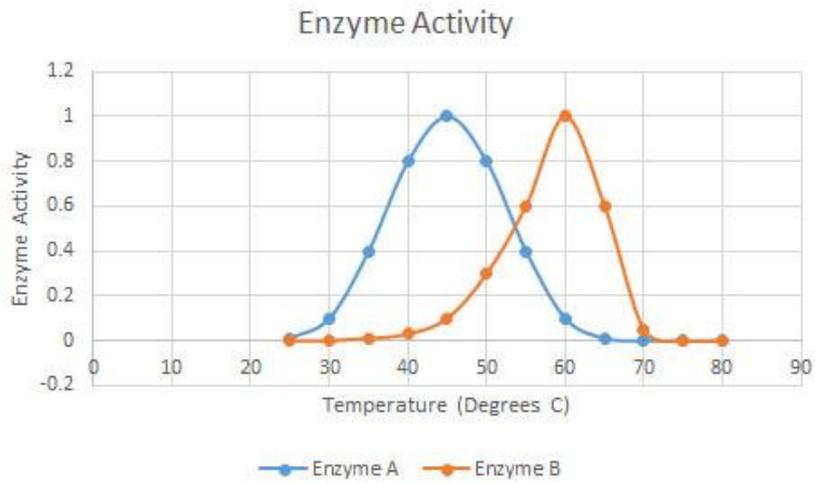
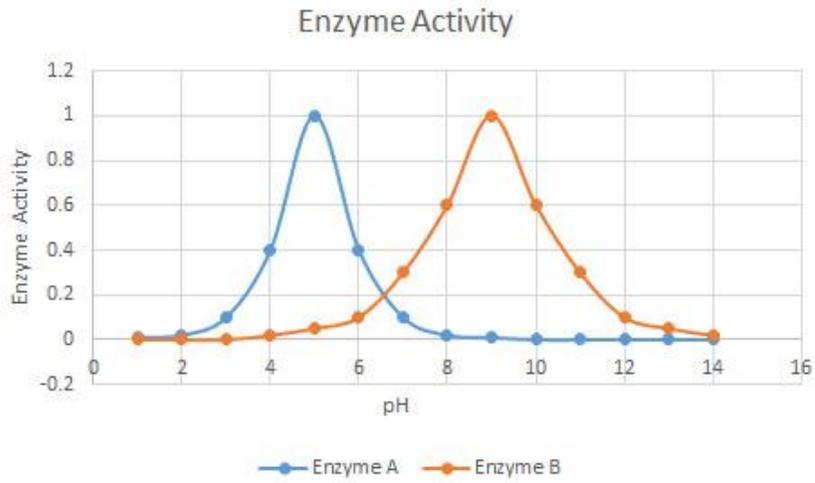
The population will remain unchanged.

None of the choices are correct.

The population will be forced to a different range.

QUESTION: 19

Use the following diagram to answer questions 8–12:

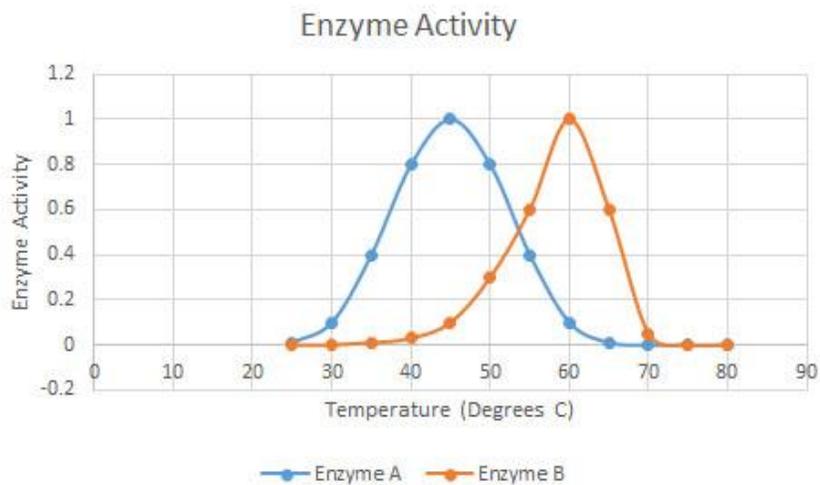
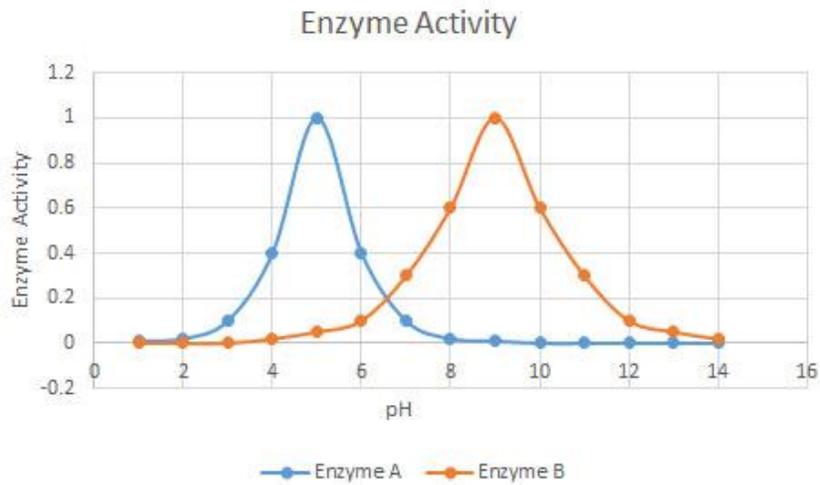


19. What are the optimal conditions (temperature and pH) for enzyme A?

-
-
-
-

QUESTION: 20

Use the following diagram to answer questions 8–12:



20. Which enzyme is more likely to function within the body?

Too little information

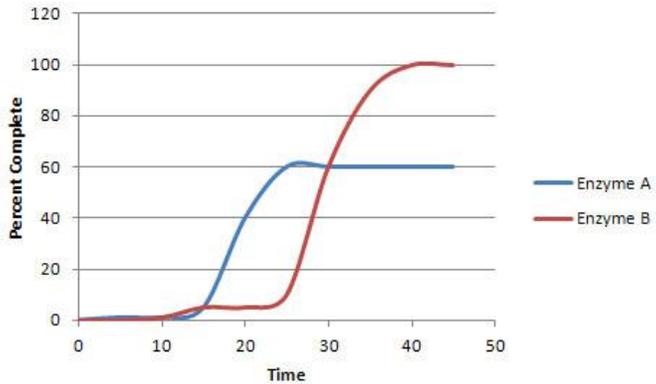
Enzyme A

Enzyme B

Both Enzymes

QUESTION: 21

21. A student is choosing an enzyme to use in order to complete a chemical reaction. Based on the diagram of enzyme kinetics, which enzyme should the student use?



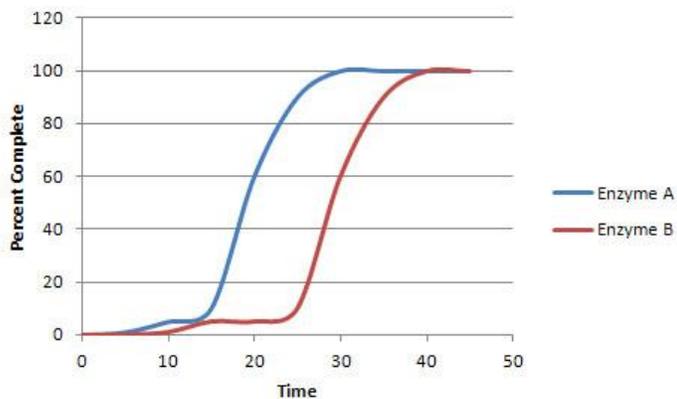
Enzyme B

Both enzymes are appropriate to use

Enzyme A

QUESTION: 22

22. A student is choosing an enzyme to use in order to complete a chemical reaction. Based on the diagram of enzyme kinetics, which enzyme is more efficient?



Enzyme A

Both enzymes are equally efficient

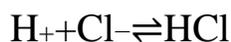
Enzyme B

QUESTION: 23

The rate of a reversible chemical reaction depends on many factors, including concentrations of the reactants and products, temperature, and presence of enzymes called catalysts. In the forward reaction, two reactants combine to form one product. However, in a reverse reaction, the product is broken down into the two reactants.

In order for a forward reaction to occur, the reactants moving around in the test tube must physically interact with each other. The more often reactants interact with each other, the more product is formed in the same amount of time. The speed at which reactants combine into products (the rate of the reaction) can be calculated by dividing the amount of a chemical produced in a reaction (often measured in moles) by the time it takes to produce that amount.

In order to determine the effects of reactant and product concentration, temperature, and presence of catalysts on the rate of a reaction, a scientist studied the following reaction:



The scientist varied the conditions of the experiment and measured the rate of the reaction. The results are outlined in Table 1. The units of concentration are moles per liter.

Experiment	Moles of H⁺	Moles of Cl⁻	Moles of HCl	Moles of Acid Convertase	Temperature (°C)	Rate of Reaction (Rate of HCl Production)
1	1	1	1	None	10	10
2	1	1	1	5	10	40
3	1	1	1	10	10	80
4	2	1	1	None	10	20
5	3	2	2	None	10	30
6	1	2	1	None	10	40
7	1	1	2	None	10	5
8	1	1	1	None	20	100

23. What is a possible unit of a rate of reaction?

Moles/Liter

Moles/Second

Seconds/Mole

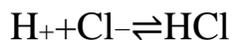
Moles/Moles

QUESTION: 24

The rate of a reversible chemical reaction depends on many factors, including concentrations of the reactants and products, temperature, and presence of enzymes called catalysts. In the forward reaction, two reactants combine to form one product. However, in a reverse reaction, the product is broken down into the two reactants.

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2	1	1	1	5	10	40
3	1	1	1	10	10	80
4	2	1	1	None	10	20
5	3	2	2	None	10	30
6	1	2	1	None	10	40
7	1	1	2	None	10	5
8	1	1	1	None	20	100

24. In a further experiment, instead of using 5 or 10 moles for the amount of acid convertase, the scientist uses 20 moles. What is the expected rate of reaction?

<input type="text" value="select"/>	
80 moles/L/S	
<input type="text" value="select"/>	
160 moles/L/S	
<input type="text" value="select"/>	
120 moles/L/S	
<input type="text" value="select"/>	
40 moles/L/S	

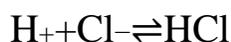
QUESTION: 25

The rate of a reversible chemical reaction depends on many factors, including concentrations of the reactants and products, temperature, and presence of enzymes called catalysts. In the forward reaction, two reactants combine to form one product. However, in a reverse reaction, the product is broken down

into the two reactants. If the reverse reaction is running at a quick rate, the overall rate of product formation will be lowered.

In order for a forward reaction to occur, the reactants moving around in the test tube must physically interact with each other. The more often reactants interact with each other, the more product is formed in the same amount of time. The speed at which reactants combine into products (the rate of the reaction) can be calculated by dividing the amount of a chemical produced in a reaction (often measured in moles) by the time it takes to produce that amount.

In order to determine the effects of reactant and product concentration, temperature, and presence of catalysts on the rate of a reaction, a scientist studied the following reaction:



The scientist varied the conditions of the experiment and measured the rate of the reaction. The results are outlined in Table 1. The units of concentration are moles per liter.

Experiment	Moles of H ⁺	Moles of Cl ⁻	Moles of HCl	Moles of Acid Convertase	Temperature (°C)	Rate of Reaction (Rate of HCl Production)
1	1	1	1	None	10	10
2	1	1	1	5	10	40
3	1	1	1	10	10	80
4	2	1	1	None	10	20
5	3	2	2	None	10	30
6	1	2	1	None	10	40
7	1	1	2	None	10	5
8	1	1	1	None	20	100

25. Why might doubling the number of moles of HCl decrease the rate of HCl production?

The acid convertase enzyme is converting HCl back into H⁺ and Cl⁻

The acid convertase enzyme has become inactive

Cannot Be Determined

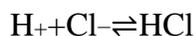
No more H⁺ or Cl⁻ exists to be converted

QUESTION: 26

The rate of a reversible chemical reaction depends on many factors, including concentrations of the reactants and products, temperature, and presence of enzymes called catalysts. In the forward reaction, two reactants combine to form one product. However, in a reverse reaction, the product is broken down into the two reactants.

In order for a forward reaction to occur, the reactants moving around in the test tube must physically interact with each other. The more often reactants interact with each other, the more produce is formed in the same amount of time. The speed at which reactants combine into products (the rate of the reaction) can be calculated by dividing the amount of a chemical produced in a reaction (often measured in moles) by the time it takes to produce that amount.

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3	1	1	1	10	10	80
4	2	1	1	None	10	20
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6	1	2	1	None	10	40
7	1	1	2	None	10	5
8	1	1	1	None	20	100

26. According to Table 1, the function of acid convertase must be to:

Not Enough Information to Determine

Increase the Rate of Reaction

Increase the Temperature of the Reaction

Decrease the Rate of Reaction

QUESTION: 27

Both gases and liquids are considered to be fluids that have individual molecules that move around with kinetic and potential energy. Kinetic energy, defined as the energy related to motion, takes three forms: translational energy that occurs as a molecule moves from position A to position B, rotational energy that occurs as a molecule spins around an imaginary axis at its center of mass, and vibrational energy that occurs as individual atoms in a molecular bond move towards and away from each other. Usually, molecules possess varying combinations of kinetic energy forms. In contrast, potential energy is defined as stored energy that could be released to become kinetic energy. The total energy of a molecule is fixed, meaning that a molecule has some combination of kinetic and potential energies.

Varying amount of kinetic and potential energies define how molecules in a fluid interact with each other. For example, when the kinetic energy of a molecule is high (greater than 1000J), it can no longer interact with neighboring molecules strongly enough to remain a liquid. However, if the potential energies are too high (greater than 1000 J), molecules cannot escape a liquid to become a gas. If the kinetic energy is high and the potential energy is low, molecules tend to become a gas and can be modeled by an equation known as the Ideal Gas Law:

$$PV=nRT$$

Where P is the pressure of a gas, V is the volume, n is the number of moles of a gas, R is a constant, and T is temperature in degrees Kelvin.

The Ideal Gas Law perfectly applies to particles with no mass, no intermolecular interactions, and no true volume. However, real molecules do not adhere perfectly to the Ideal Gas Law.

27. The relationship between total energy, kinetic energy, and potential energy could best be described as:

<input type="text" value="select"/>	
<input type="text" value="select"/>	$E_K = E_T + E_P$
<input type="text" value="select"/>	$E_T = E_K + E_P$
<input type="text" value="select"/>	$E_T = E_K - E_P$
<input type="text" value="select"/>	$E_T = E_K = E_P$

QUESTION: 28

Both gases and liquids are considered to be fluids that have individual molecules that move around with kinetic and potential energy. Kinetic energy, defined as the energy related to motion, takes three forms: translational

energy that occurs as a molecule moves from position A to position B, rotational energy that occurs as a molecule spins around an imaginary axis at its center of mass, and vibrational energy that occurs as individual atoms in a molecular bond move towards and away from each other. Usually, molecules possess varying combinations of kinetic energy forms. In contrast, potential energy is defined as stored energy that could be released to become kinetic energy. The total energy of a molecule is fixed, meaning that a molecule has some combination of kinetic and potential energies.

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28. As the kinetic energy of a molecule increases, one would expect the potential energy to:

Increase

Remain the Same

Decrease

Cannot Be Determined

QUESTION: 29

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29. If the kinetic and potential energies of a liter of oxygen molecule are 1500 J and 100 J, respectfully, the liter is most likely to be in what phase according to the passage?

<input type="button" value="select"/>	
<input type="button" value="select"/>	Cannot Be Determined
<input type="button" value="select"/>	Solid
<input type="button" value="select"/>	Liquid
<input type="button" value="select"/>	Gas

QUESTION: 30

Both gases and liquids are considered to be fluids that have individual molecules that move around with kinetic and potential energy. Kinetic energy, defined as the energy related to motion, takes three forms: translational energy that occurs as a molecule moves from position A to position B, rotational energy that occurs as a molecule spins around an imaginary axis at its center of mass, and vibrational energy that occurs as individual atoms in a molecular bond move towards and away from each other. Usually, molecules possess varying combinations of kinetic energy forms. In contrast, potential energy is defined as stored energy that could be released to become kinetic energy. The total energy of a molecule is fixed, meaning that a molecule has some combination of kinetic and potential energies.

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$$PV=nRT$$

Where P is the pressure of a gas, V is the volume, n is the number of moles of a gas, R is a constant, and T is temperature in degrees Kelvin.

The Ideal Gas Law perfectly applies to particles with no mass, no intermolecular interactions, and no true volume. However, real molecules do not adhere perfectly to the Ideal Gas Law.

30. If the kinetic and potential energies of a liter of oxygen molecules are 250 J and 1200 J, respectfully, the liter is most likely to be in what phase according to the passage?

<input type="button" value="select"/>	
<input type="button" value="select"/>	Solid
<input type="button" value="select"/>	Liquid
<input type="button" value="select"/>	Cannot Be Determined
<input type="button" value="select"/>	Gas