1. Respond to parts A, B, C, D, E, F, G, and H, and all subparts.

A. **Describe** one reproductive strategy used by a K-selected species such as the chickadee.

B. Based on the information provided, **explain** how a decrease in spider populations could affect a lower trophic level.

C. Based on the data in Figure 1, **identify** the number of spiders per sample at 25% nonnative plants.

D. Based on the data in Figure 1, **describe** the trend in the number of insects per sample in relation to the percentage of nonnative plants.

E. Scientists hypothesized that the population of chickadees would be stable or growing with fewer than 25% nonnative plants. **Describe** one way that the data in Figure 2 support this hypothesis.

F. Insect biodiversity is important to maintain ecosystem health. A group of students was interested in learning about factors that affect ant biodiversity. They located two study sites near their school: a frequently mowed urban park and an unmowed grassland. The students used traps designed to collect ants. They loaded 10 of these traps with the same food and placed them randomly at different locations within each site. Students collected the traps after 24 hours and counted the number of different ant species in each trap to determine species richness.

   i. **Identify** a likely scientific question for the students' investigation of ant diversity.

  ii. **Identify** the dependent variable in the students' investigation.

G. The data from the student investigation of ant diversity are shown in the following table. An "X" in the table indicates that the species was present at that site.

Ant Species Present in an Urban Park and Unmowed Grassland

Site	Species A	Species B	Species C	Species D	Species E	Species F
Urban park	X			X	X	
Grassland	X	X	X	X		X

   i. **Explain** why the ant community of the unmowed grassland would be more likely to recover from a disturbance, such as a flood or fire, than the ant community in the mowed urban park would.

  ii. **Explain** how the results of the investigation could have been altered if students had measured ant biodiversity at a paved playground rather than in the grassland.

H. Habitat fragmentation has impacts on a variety of species. Paved roads can lead to habitat fragmentation.

Describe one effect that a paved road in a forest can have on animal species such as deer or bears.

There is a natural climate phenomenon that occurs in the equatorial Pacific Ocean because of periodic fluctuations in sea surface conditions and atmospheric circulation. This phenomenon happens every few years, resulting in shifts in temperature and precipitation in many parts of the world.

Figure 1 shows temperature and precipitation patterns associated with one phase of this phenomenon in the equatorial Pacific Ocean. Figure 2 shows the associated temperature and precipitation patterns that occur over North America.

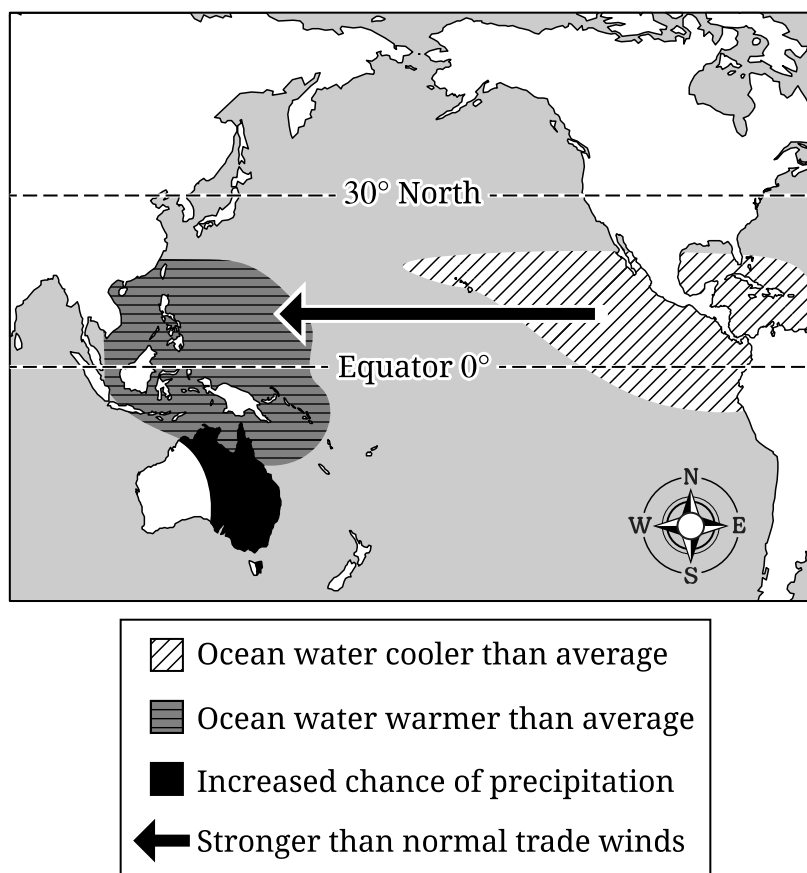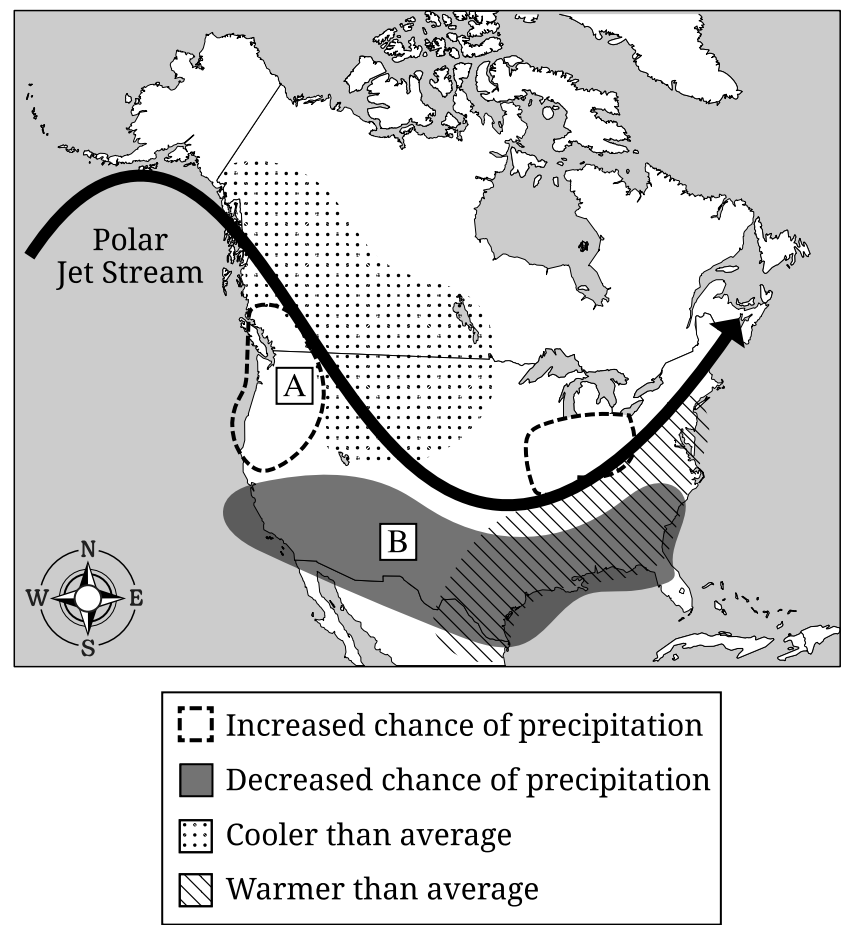**Figure 1. Effects of Changes in Sea Surface Conditions in Equatorial Pacific Ocean**

Figure 2. Polar Jet Stream and Climate Conditions in North America

Question 1: Design an Investigation   10 points

A	**Describe** one reproductive strategy used by a K-selected species such as the chickadee.	**Point 01**

Examples of acceptable responses may include the following:

- (K-selected species) provide considerable parental care for offspring.
- (K-selected species) have few offspring.
- (The parents) expend significant energy for each offspring.
- (Individuals) reproduce more than once in their lifetime.
- (K-selected species) have a long gestation period/reach reproductive maturity later.

B	Based on the information provided, **explain** how a decrease in spider populations could affect a lower trophic level.	**Point 02**

Examples of acceptable responses may include the following:

- Insects/insect populations would increase because the insects are not being preyed on/eaten as much.
- Plants/plant populations would decrease because the number of insects that eat plants will increase.

C	Based on the data in Figure 1, **identify** the number of spiders per sample at 25% nonnative plants.	**Point 03**

Examples of acceptable responses may include the following:

- 2.0
- 2

D	Based on the data in Figure 1, **describe** the trend in the number of insects per sample in relation to the percentage of nonnative plants.	**Point 04**

Examples of acceptable responses may include the following:

- As nonnative plant percentage/percent increases, the number of insects decreases.
- As nonnative plant percentage/percent decreases, the number of insects increases.
- They have an inverse/indirect/negative relationship.

E	Scientists hypothesized that the population of chickadees would be stable or growing with fewer than 25% nonnative plants. **Describe** one way that the data in Figure 2 support this hypothesis.	**Point 05**

Examples of acceptable responses may include the following:

- Below this level/With fewer than 25%, the growth rate is at/above replacement level.
- Below this level/With fewer than 25%, enough reproduction is occurring to replace the population.
- Below this level/With fewer than 25%, the population growth rate is positive.

| I | **Describe** one way burning forests contribute to atmospheric pollution. | **Point 09** |

Acceptable description point:

- Burning of trees releases CO_2/CO/NO_X/particulate matter/VOCs.

| J | **Describe** one sustainable forestry practice that could be used to reduce the occurrence or severity of forest fires. | **Point 10** |

Examples of acceptable responses may include the following:

- Prescribed burns can remove excess fuel/dead leaves/underbrush.
- Brush removal can remove excess fuel/dead leaves/underbrush.
- Selective cutting can create a fire break.
- In agroforestry, ground crops that might otherwise be fuel can be harvested/removed.

D	**Calculate** the percent change in gas mileage between the gasoline-powered SUV and the hybrid SUV based on the data provided. **Show** your work.	**Point 04**

One point for the correct setup to calculate the percent change in gas mileage.

Examples of acceptable responses may include the following:

- (36 mpg – 22 mpg) / 22 mpg x 100
- (36 – 22) / 22 x 100

	One point for the correct calculation of the percent change in gas mileage.	**Point 05**

Examples of acceptable responses may include the following:

- 63.6% increase
- 63.6%
- 63.6
- 64%
- 64

E	**Calculate** how many more miles the owner can drive in the hybrid SUV in the city than they could have driven in the gasoline-powered SUV. **Show** your work.	**Point 06**

One point for the correct setup to calculate how many more miles the hybrid SUV can drive than the gasoline-powered SUV.

Examples of acceptable responses may include the following:

- (14 gallon x 36 mpg) – (14 gallon x 22 mpg)
- (14 x 36) – (14 x 22)
- 14*(36-22)

	One point for the correct calculation of how many more miles the hybrid SUV can drive than the gasoline-powered SUV.	**Point 07**

Examples of acceptable responses may include the following:

- 196
- 200

F	**Propose** a realistic solution that schools could implement to decrease energy use for heating and cooling, other than a reduction in the amount of time the school building is occupied.	**Point 08**

Examples of acceptable responses may include the following:

- Implement green building design features
- Open windows to reduce use of air conditioning
- Use energy-efficient heating and cooling equipment
- Adjust the thermostat to reduce use of heat and air conditioning
- Install conservation landscaping