

2023 AP Daily: Practice Sessions



AP Biology

Session 4 – FRQ (Question 3: Scientific Investigation)

1. *Caenorhabditis elegans* is an approximately 1 mm long nematode (worm) that lives in the soil and eats bacteria such as *Pseudomonas*. Scientists have determined that when *C. elegans* is hunting for food, the worms have different patterns of movement that depend on the location and quality of the food source. Scientists hypothesized that *C. elegans* might be attracted to certain chemicals produced by *Pseudomonas*. They tested this hypothesis by placing 100 *C. elegans* in the center of each of a series of petri dishes containing a layer of agar over which the worms could move. A drop of a test chemical diluted in ethanol was placed at one edge of each dish and an equal-sized drop of ethanol was placed at the opposite edge of the dish. The scientists determined the number of worms to reach each spot over a period of time.
 - a. **Describe** why the location and quality of food sources in the soil are sometimes likely to stimulate random movements by *C. elegans*, but at other times are more likely to stimulate directed movements.
 - b. **Justify** the scientists' use of two different spots on each petri dish and the counting of worms at each of the two spots.
 - c. Under harsh environmental conditions, *C. elegans* produces a pheromone, a complex of molecules that affects other *C. elegans*. One effect of the pheromone is to cause developing larvae to temporarily arrest as larvae rather than mature to reproductive adults. **Predict** the relative amount of pheromone most likely produced by *C. elegans* that are only weakly attracted to one of the test chemicals.
 - d. **Provide reasoning** to justify your prediction with respect to how the predicted amount of pheromone is beneficial to the worms that are only weakly attracted to the chemical.

2. The chloroplasts of flowering land plants typically contain at least two photosynthetic pigments, chlorophyll a and chlorophyll b, that differ in the wavelengths of light they absorb. The synthesis of chlorophyll pigments from precursor molecules is a process that involves many sequential enzyme-catalyzed steps. Researchers studied the growth and photosynthetic ability of a plant that contained a mutant form of one of the enzymes required for chlorophyll biosynthesis.
- a. **Describe** the effect on chlorophyll-containing photosystems when the chlorophyll molecules absorb photons of light.
 - b. **Identify** an appropriate control that the researchers should use when they study the growth and photosynthetic ability of the plant with the mutant enzyme.
 - c. Scientists claim that a plant that has more than one type of photosynthetic pigment has greater fitness than a plant that has only one type of photosynthetic pigment. **Provide reasoning** to justify this claim.