RAISING ORPHANED OTTERS

In “Beating the Odds” (p. 8), you learned that scientists sometimes match rescued sea otter pups with an adult female otter at the aquarium. Biologists call these females surrogate mothers. Read the following passage to find out how this program began. Then use complete sentences to answer the questions that follow.

OTTER ADOPTION

For the first 17 years of Monterey Bay Aquarium’s Sea Otter Research and Conservation program (SORAC), rescued otter pups were destined for a life in captivity. That changed when an otter named Toola first served as a surrogate mother for an abandoned pup in 2001.

SORAC researchers initially tried raising abandoned pups by hand. But the otters became too accustomed to people to successfully return to the wild. Toola presented researchers with a new solution.

The adult female was living in the center because she needed daily medicine to treat seizures caused by an infection. Toola had recently given birth to a pup that did not survive, when a two-week-old abandoned pup was rescued. Researchers placed the pup with her, and she began nursing and caring for it as if it were her own.

Toola raised 12 more rescued pups before she died in 2012. Her success prompted researchers to pair pups with other females at the center.

Today, rescued pups spend roughly 20 weeks with their foster moms learning how to find food. Being raised by otters gives the pups roughly the same chance of survival as pups raised in the wild.

QUESTIONS

1. Why can’t otter pups raised by humans be successfully released back into the wild?

2. Why was Toola living in the SORAC center?

3. What event happened that likely prompted scientists to try pairing the two-week-old pup with Toola?

4. Which piece of evidence from the text supports the idea that using otters as surrogate moms is a successful program?

5. When Toola died, workers at SORAC called her the most important animal in the history of the program. Explain why you think they said that.

6. In “Beating the Odds” (p. 8), you learned that Luna was not given a surrogate mother. Why?
HURLING BIRDS

In “Crafty Chemistry” (p. 12), you read about how chemistry is being used in a popular video game. *Minecraft* isn’t the only game that relies on real-world science. In *Angry Birds*, players launch vengeful birds from slingshots to smash mean, green pigs. The projectile motion of some of the birds follows realistic laws of physics.

The slung birds follow a curved trajectory similar to the path a real object travels when it is thrown. As the object flies through the air, the downward force of gravity pulls on it, eventually causing it to hit the ground. How far the object travels depends on its initial velocity and the angle at which it is launched. To hit a target, players have to launch the birds from the optimal angle so the bird’s range is on target.

Use the projectile-motion equations below to learn how launch angle and initial velocity affect how far an angry bird flies. The equations calculate the range in meters (m) and use the initial velocity measured in meters per second (m/s) and the acceleration due to the force of gravity as 9.8 meters per second squared (m/s²). Round your answers to the nearest hundredth.

**EQUATIONS**

<table>
<thead>
<tr>
<th>Launch Angle</th>
<th>Range Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>30° LAUNCH ANGLE</td>
<td>( \text{Range} = \left( \frac{\text{Initial Velocity}^2}{\text{Acceleration Due to Gravity}} \right) \times 0.87 )</td>
</tr>
<tr>
<td>45° LAUNCH ANGLE</td>
<td>( \text{Range} = \left( \frac{\text{Initial Velocity}^2}{\text{Acceleration Due to Gravity}} \right) \times 1 )</td>
</tr>
<tr>
<td>70° LAUNCH ANGLE</td>
<td>( \text{Range} = \left( \frac{\text{Initial Velocity}^2}{\text{Acceleration Due to Gravity}} \right) \times 0.64 )</td>
</tr>
</tbody>
</table>

**QUESTIONS**

1. A bird is launched with an initial velocity of 10 m/s at an angle of 30° to the ground. What is the range of the bird?

2. A bird is launched with an initial velocity of 10 m/s at an angle of 45° to the ground. How far will this bird travel in the horizontal direction?

3. A bird is launched with an initial velocity of 10 m/s at an angle of 70° to the ground. What is this bird’s range?

4. A bird is launched with an initial velocity of 5 m/s at an angle of 30° to the ground. What is the bird’s range?

5. The last bird is launched at a 45° angle and travels 9 meters. What was this bird’s initial velocity?

6. In the game *Angry Birds*, players can only control the launch angle of the birds. Suppose a player wants to maximize their bird’s range. Which of the launch angles from your calculations above should the player choose?
In “Why It’s a Bad Idea to Pee in the Pool” (p. 20), you learned that chlorine is used to kill microbes in swimming pools. Read the following passage to learn how the chemical kills bacteria. Then answer the questions that follow.

WATER DISINFECTION

Think chlorine is just for swimming pools? The chemical is also used in 98 percent of the water-treatment facilities in the United States to clean drinking water. Chlorine helps kill potentially dangerous bacteria that can live in water.

Before chlorine began being used to clean drinking water supplies in 1908, outbreaks of diseases caused by waterborne microbes, such as typhoid fever, dysentery, and cholera, were far more common. Scientists credit chlorine for virtually eliminating those potentially deadly diseases in the U.S.

When chlorine-containing solutions are poured into pools or drinking water, the chemicals form different compounds, including negatively-charged hypochlorite (OCl-) and hypochlorous acid (HOCl)—a weak acid. Scientists believe that hypochlorous acid kills bacteria by breaking down the microbes’ protective cell walls. That allows chemicals to enter the cells and destroy the proteins inside that allow the bacteria to survive.

Chlorine isn’t as effective as killing certain single-celled protozoa such as Giardia, which can cause stomach ailments. So scientists still recommend that sick people stay out of the pool.

QUESTIONS

1. Which of the following statements BEST represents the central idea of the passage?
   A. Chlorine helps keep water supplies safe.
   B. Chlorine is important for swimming pools.
   C. Bacteria can cause potentially deadly diseases.
   D. Diseases can spread through water.

2. What is a waterborne microbe?
   A. a microbe that is killed by chlorine
   B. a bacterium that can’t survive in water
   C. a microorganism that lives in and spreads through water
   D. a type of acid

3. How does chlorine kill bacteria?
   A. It kills their food supply.
   B. It reduces the oxygen content in the water.
   C. It heats up the bacteria.
   D. It breaks down the microbes’ cell walls.

4. Some say that chlorine is the most significant public-health advance of the past century. Which of the following facts from the article BEST supports that statement?
   A. Chlorine breaks down the cell walls of dangerous microbes.
   B. Chlorine is used in 98 percent of the water-treatment facilities in the United States to clean drinking water.
   C. Before chlorine began being used to clean drinking-water supplies in 1908, outbreaks of typhoid fever, dysentery, and cholera were far more common.
   D. Chlorine is not as effective at killing protozoa.

5. In your own words, explain how chlorine helps protect swimmers from infections caused by certain microbes but not from toxins created by urinating in a pool.
BEATING THE ODDS Page 8

DIRECTIONS: Fill in the blanks in the following sentences. Use the words in the word bank below.

<table>
<thead>
<tr>
<th>Big Sur</th>
<th>female otters</th>
<th>humans</th>
<th>San Francisco</th>
</tr>
</thead>
<tbody>
<tr>
<td>blubber layer</td>
<td>fertilizer</td>
<td>Monterey Bay</td>
<td>sea lions</td>
</tr>
<tr>
<td>crabs</td>
<td>formula</td>
<td>Oregon</td>
<td>Shedd Aquarium</td>
</tr>
<tr>
<td>eelgrass</td>
<td>fur trade</td>
<td>oxygen</td>
<td></td>
</tr>
</tbody>
</table>

1. The _______________ almost wiped out sea otters hundreds of years ago.

2. A small population of sea otters survived near ________________, an area that once had no road access.

3. Scientists believe that the sea otter population will soon expand to reach ________________.

4. _______________ runoff from farms can cause algae to overgrow.

5. Thick layers of algae in the water can use up _______________ needed by other organisms.

6. _______________ provides an important habitat for invertebrates and fish.

7. Sea otters keep populations of _______________ from growing out of control.

8. Luna now lives at ________________ in Chicago.

9. Adult _______________ can teach rescued baby sea otters how to survive in the wild.

10. Rescued baby sea otters drink a specialized _______________ from a bottle.

CRAFTY CHEMISTRY, Page 12

DIRECTIONS: Read each statement and decide whether it is true (T) or false (F). Write your response in the space provided.

_____ 1. More than 100 million people play the video game Minecraft worldwide.

_____ 2. “Sandbox” video games restrict players to playing in a predesigned world.

_____ 3. Polycraft World is a standalone video game similar to Minecraft.

_____ 4. In Polycraft World, tungsten ore is used to make metal tools.

_____ 5. In real life and in Minecraft, trees can be used to make some types of rubber.
JURASSIC REALITY CHECK, Page 14
DIRECTIONS: Match each item in the left-hand column below with its definition or description in the right-hand column.

____ 1. avian  a. prehistoric sea reptile that has an extra row of teeth
____ 2. scaly skin  b. dinosaur species that was mislabeled as a Velociraptor in a book Michael Crichton used while writing Jurassic Park
____ 3. sauropods  c. feature located on the top of the skulls of some dinosaurs
____ 4. birds and lizards  d. the fourth movie in the Jurassic Park series
____ 5. feathers  e. long-necked, plant-eating dinosaurs
____ 6. Jurassic World  f. inaccurate feature depicted on the Velociraptors in Jurassic World
____ 7. Velociraptor  g. birdlike
____ 8. mosasaur  h. living relatives of dinosaurs
____ 9. nasal opening  i. dinosaur species that was roughly the size of a turkey
____ 10. Deinonychus  j. feature now believed to have been found on many dinosaur bodies

WHY IT’S A BAD IDEA TO PEE IN THE POOL, Page 20
DIRECTIONS: Answer the following questions in complete sentences.

1. What is the purpose of sebaceous glands? __________________________________________
   __________________________________________

2. Why might a dog with a long coat stink more than a short-haired dog?____________________
   __________________________________________
   __________________________________________

3. What is angular momentum? ______________________________________________________
   __________________________________________

4. Explain why a skipping stone hops into the air when it hits the water.____________________
   __________________________________________
   __________________________________________
   __________________________________________

5. What is uric acid? _________________________________________________________________
   __________________________________________
Name:

DIRECTIONS: Use the clues below to fill in the crossword puzzle. All answers can be found in this issue.

ACROSS
3. A force that keeps an object at a fixed angle (two words)
5. Unprocessed crude oil
7. An area south of Monterey Bay, California, where a population of sea otters lives (two words)
12. A planet found outside our solar system
13. Structures made up of coral
14. A type of acid found in urine (two words)
15. This forms when electrons of an atom become energized.

DOWN
1. Scientists believe they could create a dinosaur from this bird’s embryo.
2. A fishing practice that uses explosives (two words)
4. This waxy substance is produced by sebaceous glands under the skin.
6. Fishermen recently captured this type of deep-sea shark (two words).
8. A condition in which unhealthy coral turns white (two words)
9. Scientists believe that many dinosaurs were covered with these.
10. A population of microorganisms
11. The name of a popular video game in which users create the world they play in.