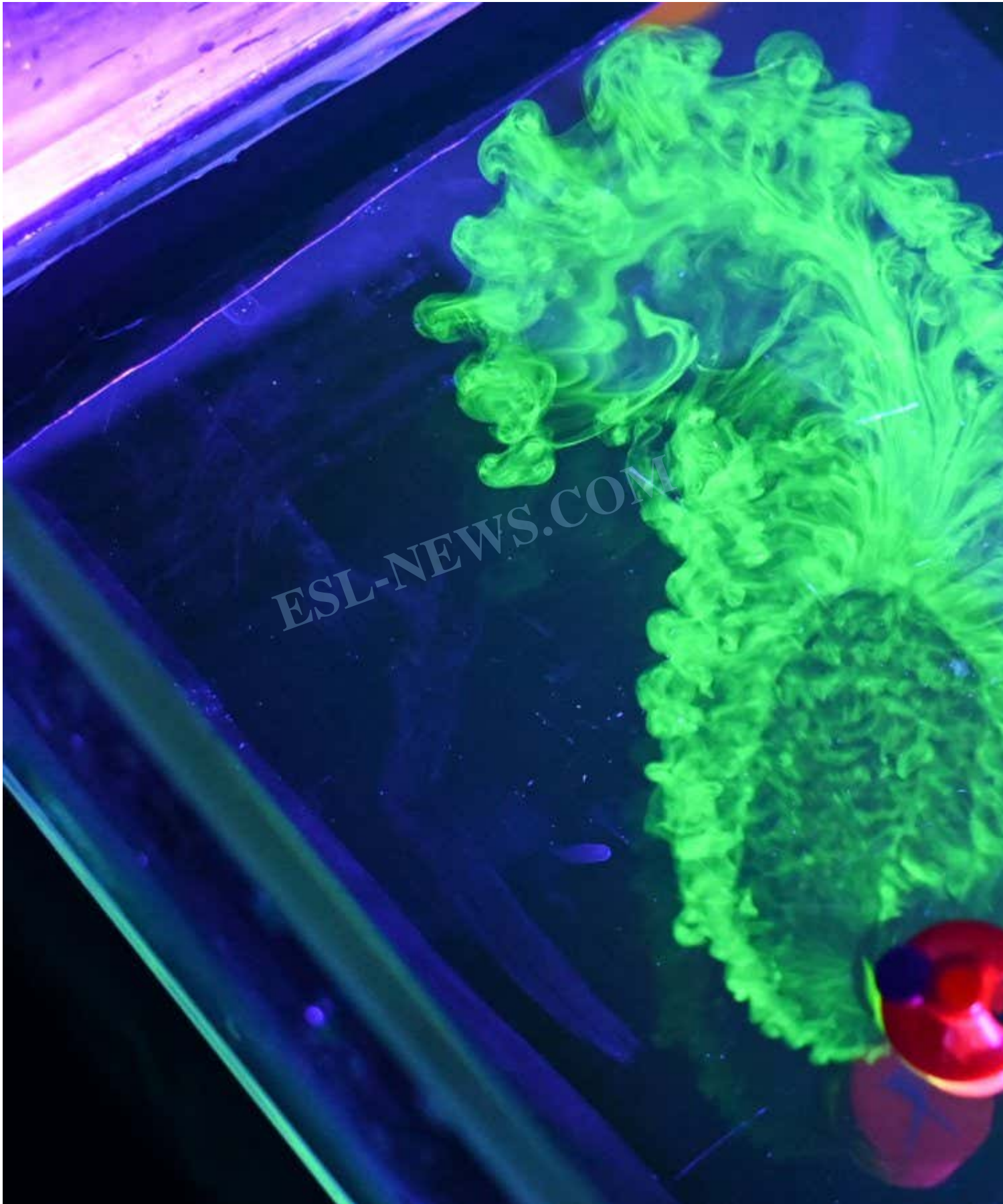




## Inspired by Cheerios: New Robot Design Unveiled

### Description

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Beetles can float across ponds and Cheerios can stick together in a bowl. Tiny floating robots use a similar effect called the Marangoni effect. It happens when a liquid spreads quickly over another liquid with a different surface tension.

Researchers at Harvard University made small round robots with air inside and fuel made of alcohol. The alcohol leaks out slowly, making the robot move on water.

The robots move faster with stronger alcohol. They can make wide curves or spin when many robots are stuck together. This is similar to how Cheerios stick together in a bowl.

These 3D-printed robots can help students learn surface tension concepts. They can also be used in the environment or industry to spread chemicals evenly without human help.

These robots have interesting uses and behaviors that make them helpful in many fields.

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## Vocabulary List:

1. **Marangoni** /,mæɪ.ə'gɒʊ.ni/ (noun): A phenomenon where a liquid spreads quickly over another liquid due to differences in surface tension.
2. **Robots** /'rɒʊ.bə:ts/ (noun): Machines capable of carrying out a complex series of actions automatically.
3. **Surface Tension** /'sɜr.fɪs 'tɛn.jən/ (noun): The characteristic of a liquid surface that makes it behave like a stretched elastic membrane.
4. **Alcohol** /'æɪ.kə.hɔ:l/ (noun): A class of chemical compounds of which ethanol is the most commonly used as a fuel.
5. **Chemicals** /'kɛm.i.kəlz/ (noun): Substances used in or produced by chemical processes.
6. **Curves** /kɜrvz/ (noun): Smooth continuous lines or paths that are not straight.

## Comprehension Questions

### Multiple Choice

1. What is the name of the effect that tiny floating robots use to move on water?

Option: Marangoni effect

Option: Buoyancy effect

Option: Capillary action

Option: Surface tension effect



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2. What type of fuel do the small round robots have?

- Option: Gasoline
- Option: Alcohol
- Option: Electricity
- Option: Biofuel

3. What helps the robots move faster?

- Option: Air inside them
- Option: Stronger alcohol
- Option: Buoyant force
- Option: Electric propulsion

4. How can multiple robots spin?

- Option: By releasing air bubbles
- Option: By magnetic force
- Option: By sticking together
- Option: By changing shape

5. What can these 3D-printed robots be used for in education?

- Option: Learning about gravity
- Option: Understanding buoyancy
- Option: Exploring aerodynamics
- Option: Teaching surface tension concepts

6. In which fields can these robots be helpful?

- Option: Space exploration only
- Option: Medical industry only
- Option: Many fields
- Option: Entertainment industry

### **True-False**

7. Beetles can float across ponds and Cheerios can stick together in a bowl.

8. The alcohol leaks out slowly, causing the robots to move on water.

9. The robots can only move in straight lines on water.



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10. These robots are not useful in educational settings.
11. The Marangoni effect occurs when liquids with different surface tensions interact.
12. These robots cannot spread chemicals evenly in industrial applications.

### Gap-Fill

13. Tiny floating robots use a similar effect called the \_\_\_\_\_ effect.
14. The robots move faster with \_\_\_\_\_ alcohol.
15. These 3D-printed robots can help students learn \_\_\_\_\_ concepts.
16. The robots can also be used in the environment or industry to spread chemicals evenly without human \_\_\_\_\_.
17. The robots have interesting uses and behaviors that make them helpful in \_\_\_\_\_ fields.
18. The researchers at Harvard University made small round robots with \_\_\_\_\_ inside and fuel made of alcohol.

### Answer

**Multiple Choice:** 1. Marangoni effect 2. Alcohol 3. Stronger alcohol 4. By sticking together 5. Teaching surface tension concepts 6. Many fields

**True-False:** 7. True 8. True 9. False 10. False 11. True 12. False

**Gap-Fill:** 13. Marangoni 14. stronger 15. surface tension 16. help 17. many 18. air

### Vocabulary quizzes

#### Multiple Choice ( Select the Correct answer for each question. )

1. What technology is commonly used to detect changes in the environment?



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- Option: A. Sensors  
Option: B. Robots  
Option: C. Subscription  
Option: D. Competition
2. Who are the individuals receiving medical care or treatment?  
Option: A. Subscription  
Option: B. Patients  
Option: C. Pollution  
Option: D. Consumers
3. What is the act of allocating money or resources in the expectation of benefit in the future?  
Option: A. Investment  
Option: B. Sensors  
Option: C. Proposal  
Option: D. Treaty
4. What term refers to the quality of being coherent and intelligible?  
Option: A. Robots  
Option: B. Clarity  
Option: C. Extinction  
Option: D. Marangoni
5. Who are the people who purchase goods and services for personal use?  
Option: A. Emissions  
Option: B. Investment  
Option: C. Consumers  
Option: D. Track
6. What refers to the introduction of harmful substances into the environment?  
Option: A. Pollution  
Option: B. Track  
Option: C. Sensors  
Option: D. Commission
7. What quality denotes the degree of conformity of a measured or calculated quantity to its actual value?  
Option: A. Competition  
Option: B. Harmful  
Option: C. Accuracy  
Option: D. Identify
8. What category do substances utilized in chemical processes belong to?  
Option: A. Treaty
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- Option: B. Chemicals
- Option: C. Sensors
- Option: D. Subscription

9. What term denotes the state or process of a species family or larger group being or becoming extinct?

- Option: A. Subscription
- Option: B. Accuracy
- Option: C. Extinction
- Option: D. Sensors

10. What physical property of liquids causes them to minimize their surface area?

- Option: A. Robots
- Option: B. Marangoni
- Option: C. Surface Tension
- Option: D. Identify

**Gap-Fill ( Fill in the blanks with the correct word from the vocabulary list. )**

11. Continuous \_\_\_\_\_ of the patient's vital signs is essential in critical care.
12. You can enjoy ad-free music by getting a premium \_\_\_\_\_ to the streaming service.
13. Before the project can begin the team needs to submit a detailed \_\_\_\_\_ for approval.
14. The success of the experiment relied on the \_\_\_\_\_ of the measurements taken.
15. Making a smart \_\_\_\_\_ in your education can lead to better career opportunities.
16. It is important to segregate waste so that materials can be \_\_\_\_\_ and reused.
17. Exposure to certain substances can have \_\_\_\_\_ effects on human health.
18. Forensic scientists use various techniques to \_\_\_\_\_ unknown substances found at crime scenes.
19. The GPS system allows you to \_\_\_\_\_ the location of your delivery in real-time.
20. The artist received a \_\_\_\_\_ for a sculpture to be placed in the city park.



**Matching Sentences ( Match each definition to the correct word from the vocabulary list. )**

21. Organizations strive to outperform rivals in a market with similar products or services.
22. Individuals or households that use goods or services generated within an economy.
23. Phenomenon where surface tension gradients drive flow between two fluid regions.
24. Automated machines designed to carry out tasks typically performed by humans.
25. Formal agreement between multiple states to regulate various aspects of their relationships.
26. Release of pollutants or gases into the atmosphere typically from vehicles or industrial processes.
27. Regular payment made to access services or content over a period of time.
28. A formal suggestion or plan submitted for consideration or discussion.
29. To establish or recognize the nature of someone or something.
30. To observe and check the progress or quality of something over a period of time.

**Answer**

**Multiple Choice:** 1. A. Sensors 2. B. Patients 3. A. Investment 4. B. Clarity 5. C. Consumers 6. A. Pollution  
7. C. Accuracy 8. B. Chemicals 9. C. Extinction 10. C. Surface Tension

**Gap-Fill:** 11. monitoring 12. subscription 13. proposal 14. accuracy 15. investment 16. recycled 17. harmful  
18. identify 19. track 20. commission

**Matching sentence:** 1. Competition 2. Consumers 3. Marangoni 4. Robots 5. Treaty 6. Emissions 7.  
Subscription 8. Proposal 9. Identify 10. Monitor

**CATEGORY**

1. Sci/Tech - LEVEL2

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