

Reading Passage 2

You should spend about 20 minutes on **Questions 15-27**, which are based on **Reading Passage 2**.

TEABAGS AND CLIMATE CHANGE

How teabags became a secret weapon in the fight against climate change.

A. Teabags, which seem to be humble, but turn out to provide an ingenious window onto a largely hidden world: soil. When soil litter – dead leaves, twigs and other organic material – decomposes, it emits carbon dioxide, which contributes to global warming. Being able to measure the rate at which this happens is important – and nowhere more so than in the Arctic, where the tundra holds vast quantities of carbon and is emitting it into the air at an accelerating rate as the land heats up. Sizing up this problem should allow us to better predict the ramifications of a warmer world, and chart a course to avert disastrous climate change.

B. It started in 2010, when Joost Keuskamp and Judith Sarneel at Utrecht University in the Netherlands had a eureka moment. Both study soil decomposition, and their research entails sewing or gluing together the seams of hundreds of tiny bags, filling them with dead plant material, then burying them in the ground. The ecologists later dig up the bags and reweigh them to track the progress of decay. During a well-earned tea break, the pair were bemoaning the tedium of this time-consuming job. If only there were some way to avoid it, they mused, while staring into the depths of their teacups. Teabags! It was a genius idea. Not only would using them bypass all the sewing and gluing, but if ecologists everywhere buried the same type of teabag instead of homemade litterbags, it would also give them a standard piece of kit with which to do their studies.

C. Soil decomposition occurs when microorganisms, including fungi and bacteria, digest dead plant material, transforming it into nutrients and releasing carbon dioxide. The rate of decay depends on environmental conditions such as humidity, temperature, soil acidity and nutrient content, together with the chemical properties of the litter and the types of microorganisms present. It is a two-stage process. Typically, decay is fast at first, as microbes consume all the easily degraded organic material. In the next phase, the decomposition rate is slower because the material left behind is more resistant.

D. After much trial and error, Sarneel, now at Umeå University in Sweden, and Keuskamp realised that, by burying two different types of tea for two or three months, they could capture data on both phases at the same time. Woody rooibos tea, also known as redbush, is slow to decompose, so the amount of weight lost gives a measure of the initial decay rate. Meanwhile, rapidly decomposing green tea quickly reaches the slower phase of decay, so can be used to measure its rate. The Tea Bag Index – a standardized system of classification was born. Since Sarneel and Keuskamp publish their method in 2013, teabag ecology has taken off. Last year, the first global comparative study of soil litter decomposition was published by the TeaTime4Science website, a collaboration of researchers from more than 190 institutions over the world.

E. They looked at early stage decay rates of the two types of teabags in soil at 336 sites within nine different biomes, including boreal forests, equatorial regions, the Mediterranean and Arctic tundra. They found that rooibos tea always decayed much slower than green tea, reassuring them that the Tea Bag Index works in vastly different geographical areas and biomes. As expected, decay of both tea types was faster in warmer, more humid environments. However, for tea at least, moisture levels have more impact on decomposition rates than temperature.

F. Being able to make such global comparisons is a huge leap forward for soil scientists. But the group acknowledged that data from the Arctic was sparse. That matters because tundra contains huge amounts of carbon – almost twice as much as the atmosphere – in the form of dead vegetation.

G. Historically, low temperatures in the Arctic have kept the decomposition rates in tundra soil low, locking up this carbon. With global warming, that is no longer the case. However, we don't know how fast carbon dioxide is being released from the tundra into the atmosphere or what impact this will have. That is what Myers-Smith and her team are trying to find out. They are particularly keen to examine the unusual changes that are occurring in places like Herschel Island, where rising temperatures are leading to increased plant growth. "One of the big questions is, what happens to that biomass once it gets deposited into the soil," says Myers-Smith. Might it rapidly decompose, creating a feedback loop that makes things worse?

H. To tackle this question, Thomas heads up the Tundra Tea Bag Experiment, an international collaboration involving some 50 researchers. It has buried teabags at over 350 sites worldwide and aims to find out how decomposition rates across the tundra differ with changes in soil and air temperature and moisture. Analysis is ongoing, but early hints are concerning. In the Arctic, soils are often below 0°C but warm up through the summer. As temperature and moisture increase, decomposition speeds up. The researchers had predicted – in line with assumptions used by many climate models – that after an initial spurt, rates of decay would begin to level off. That isn't happening.

I. "We're seeing a linear relationship across the whole tundra," says Myers-Smith. "Some of the highest rates of decomposition occurred at sites that were the warmest and the wettest." She hopes that the findings, which will be published soon, will be used to update climate models and improve our ability to predict the effects of climate change at high latitudes.

Questions 14-19

Reading Passage 2 has seven sections **A-I**.

Which section contains the following information?

Write the correct letter **A-I** in boxes **15-20** on your answer sheet.

- 14. a detailed description of a natural process
- 15. an unsolved mystery regarding the possible scenario of a strange phenomenon
- 16. a reference to an unexpected discovery
- 17. the name of a particular research which was conducted on a global scale
- 18. evidence for the practicality of a standardized system on various regions
- 19. the publication of a research method which helps an area of research flourish

Questions 20-26

Do the following statements agree with the information given in Reading Passage 2?

In boxes 20-26 on your answer sheet, write:

TRUE	<i>if the statement agrees with the information</i>
FALSE	<i>if the statement contradicts the information</i>
NOT GIVEN	<i>if there is no information on this</i>

20. *The rate at which the Arctic tundra is emitting carbon has been stabilizing over the past few years.*
21. *Joost Keuskamp and Judith Sarneel discovered the potential scientific use of teabags when they are analyzing the results of their experiment.*
22. *The rate of decay is affected by various environmental factors.*
23. *The soil's decomposition process is divided into 2 stages with different rates.*
24. *Researchers in Umeå University found evidence for the cost-effectiveness of burying two different types of tea.*
25. *Among all types, green tea has the fastest decay rate.*
26. *The effect of temperature on tea decomposition rate is similar to that of moisture.*