Carbon's New Math

To deal with global warming, the first step is to do the number.

A . Here's how it works. Before the industrial revolution, the Earth's atmosphere contained about 280 parts per million of carbon dioxide. That was a good amount "good" defined as "what we were used to." Since the molecular structure of carbon dioxide traps heat near the planet's surface that would otherwise radiate back out to space, civilization grew up in a world whose thermostat was set by that number. It equated to a global average temperature of about 57 degrees Fahrenheit (about 14 degrees Celsius), which in turn equated to all the places we built our cities, all the crops we learned to grow and eat, all the crops we learned to grow and eat, all the water supplies we learned to depend on, even the passage of the seasons that, at higher latitudes, set our psychological calendars.

B . Once we started burning coal and gas and oil to power our lives, that 280 number started to rise. When we began measuring in the late 1950s, it had already reached the 315 level. Now it's at 380, and increasing by roughly two parts per million annually. That doesn't sound like very much, but it turns out that the extra heat that CO2 traps, a couple of watts per square meter of the Earth's surface, is enough to warm the planet considerably. We've raised the temperature more than a degree Fahrenheit (0.56 degrees Celsius) already. It's impossible to precisely predict the consequences of any further increase in CO2 in the atmosphere. But the warming we've seen so far has started almost everything frozen on Earth to melting; it has changed seasons and rainfall patterns; it's set the sea to rising.

C . No matter what we do now, that warming will increase some there's a lag time before the heat fully plays out in the atmosphere. That is, we can't stop global warming. Our task is less inspiring; to contain the damage, to keep things from getting out of control. And even that is not easy. For one thing, until recently there's been no clear data suggesting the point where catastrophe looms. Now we're getting a better picture- the past couple of years have seen a series of reports indicating that 450 parts per million CO2 are a threshold we'd be wise to respect. Beyond that point, scientists believe future centuries will likely face the melting of the Greenland and West Antarctic ice sheets and a subsequent rise in sea level of giant proportion. Four hundred fifty parts per million is still a best (and it doesn't include the witches' brew of other, lesser, greenhouse gases like methane and nitrous oxide). But it will serve as a target of sorts for the world to aim at. a target that's moving fast. If concentrations keep increasing by two parts p[per million per year, we're only three and a half decades away.

D . So the math isn't complicated-but that doesn't mean it isn't intimidating. So far only the Europeans and Japanese have even begun to trim their carbon emissions, a quarter of the world's total, continue to rise steadily. China and India are suddenly starting to produce huge quantities of CO2 as well.

E . Everyone involved knows what the basic outlines of a deal that could avert catastrophe would look like; rapid, sustained, and dramatic cuts in emissions by the technologically advanced countries, coupled with large-scale technology transfer to the developing world so that

they can power up their emerging economies without burning up their coal. Everyone knows the big question, too; Are such rapid cuts even possible?

F . The question- is it even possible?- is usually addressed by fixating on some single new technology (hydrogen! ethanol!) and imagining it will solve our troubles. But the scale of the problem means we'll need many strategies. Most people have heard of some of them; more fuel-efficient cars, better-built homes, wind turbines, biofuels like ethanol. Others are newer and less sure; plans for building coal-fired power plants that can separate carbon from the exhaust so it can be "sequestered" underground.

G . These approaches have one thing in common; They're more difficult than simply burning fossil fuel. They force us to realize that we've already had our magic fuel and that what comes next will be in the trillions of dollars. Of course, along the way, it will create myriad new jobs, and when it's complete, it may be a much more elegant system. And since we're wasting so much energy now, some of the first tasks would be relatively easy. If we replaced every incandescent bulb that burned out in the next decade anyplace in the world with a compact fluorescent, we'd make an impressive start on one of the 15 wedges. But in that same decade we'd need to build 400000 large wind turbines clearly possible, But only with real commitment. We'd need to follow the lead of Germany and Japan and seriously subsidize rooftop solar panels; we'd need to get most of the world's farmers plowing their fields less, to build back the carbon their soils have lost. We'd need to do everything all at once.

H . As precedents for such collective effort, people sometimes point to the Manhattan project to build a nuclear weapon or the Apollo Program to put a man on the moon. But those analogies don't really work. They demanded the intense concentration of money and intelligence on a single small niche in our technosphere. Now we need almost the opposite a commitment to take what we already know how to do and somehow spread it into every corner of our economies, and indeed our most basic activities. It's as if NASA's goal had been to put all of us on the moon.

I . Not all the answers are technological, of course, maybe not even most of them. Many of the paths to stabilization run straight through our daily lives, and in every case, they will demand difficult changes. Air travel is one of the fastest growing sources of carbon emissions around the world, for instance, but even many of us who are noble about changing lightbulbs and happy to drive hybrid cars chafe at the thought of not jetting around the country or the world. By now we're used to ordering take-out food from every corner of the world every night of our lives according to one study, the average bite of food has traveled nearly 1500 miles (2414 kilometers) before it reaches an American's lips, which means it's been marinated in (crude) oil.. We drive alone, because it's more convenient than adjusting our schedules for public transit. We build ever bigger homes even as our family sizes shrink, and we watch ever bigger TV's and well, enough said. We need to figure out how to change those habits.

J . Probably the only way that will happen is if fossil fuel costs us considerably more. If what we paid for a gallon of gas reflected even a portion of its huge environmental cost, we'd be driving small cars to the train station, just like the Europeans. And we'd be riding bikes when the sun shone.

K . The most straightforward way to raise the price would be a tax on carbon.; but that's not easy. Since everyone needs to use fuel, it would be regressive-you'd have to figure out how to keep from hurting poor people unduly. And we'd need to be grown up enough to have a real conversation about taxes-say about switching away from taxes on a thing we like(employment) to taxes on things we hate(global warming).

L . In the end, global warming presents the greatest test we humans have yet faced. are we ready to change, in dramatic and prolonged ways, in order to offer a workable future to subsequent generations and diverse forms of life? If we are, new technologies and new habits offer some promise. It's our coming of age moment, and there are no certainties or guarantees. Only a window of possibility, closing fast but still ajar enough to let in some hope.

Questions 1-8

Summary

Complete the following summary of the paragraphs of Reading Passage, using no more than two words from the Reading Passage for each answer. Write your answers in boxes 1-8 on your answer sheet.

Several hundred years ago, the amount of carbon dioxide contained in the Earth's the atmosphere was **.....1.....** parts per million. However, with a growth of about **....2.....**parts per millions every year, the number has risen from **.....3.....** in the late 1950s to the current **.....4.....** As scientists believe, the figure should beexceed **.....5.....** parts per million; otherwise, humans will be faced with a significant rise of sea level. Considering the severity of the problem, various approaches are needed to tackle it. Parts of the solutions are .....6....., like fuel-efficient cars and wind turbines, but many other ways to cut down carbon dioxide emission lie in our.....7..... In other words, it is necessary for us to change some of our habits, such as to reduce our reliance on air travel and car use. Perhaps the most direct way will be to impose a ....8..... on carbon to discourage people to use fossil fuel by increasing the price.

Questions 9-13

Do the following statements agree with the information given in Reading Passage 1? In boxes **9-13** on your answer sheet, write

True If the statement is true.

False If the statement is false

Not Given If the information is not given in the passage.

9. There has already been explicit evidence showing 450 parts per million CO2 is the point beyond which disasters will take place.

10. The developing countries have contributed the most to the total CO2 emission around the world.

11. Humans will have to pay a heavy price for the awful mess after their ease to burn fossil fuel.

12. The collective effort to cut down carbon emission is just like that of the Manhatten project or the Apollo Program.

13. Many people are reluctant to accept the idea of not traveling around by plane.

Section-2

The Lost City

Thanks to modern remote-sensing techniques, a ruined city in Turkey is slowly revealing itself as one of the greatest and most mysterious cities of the ancient world. Sally Palmer uncovers more.

A . The low granite mountain, known as Kerkenes Dag, juts from the northern edge of the Cappadocian plain in Turkey. Sprawled over the mountainside are the remains of the fabled city of Pteria, the sixth-century BC stronghold of the Medes that the Greek historian Herodotus described in his famous work The Histories. The short-lived city came under Median control and only fifty years later was sacked, burned and its strong stone walls destroyed.

B . British archeologist Dr. Geoffrey Summers has spent ten years studying the site. Excavating the ruins is a challenge because of the vast area they cover. The 7km perimeter walls run around a site covering 271 hectares. Dr. Summers quickly realized it would take far too long to excavate the site using traditional techniques alone. Sop he decided to use modern technology as well to map the entire site, both above and beneath the surface, to locate the most interesting areas and priorities to start digging.

C . In 1993, Dr. Summers hired a special hand-held balloon with a remote-controlled camera attached. He walked over the entire site holding the balloon and taking photos. Then one afternoon, he rented a hot-air balloon and floated over the site, taking yet more pictures. By the end of the 1994 seasons, Dr. Summers and his team had a jigsaw of aerial photographs of the whole site. The next stage was to use remote sensing, which would let them work out what lay below the intriguing outlines and ruined walls." Archaeology is a discipline that lends itself very well to remote sensing because it revolves around space," says Scott Branting, an associated director of the project. He started working with Dr. Summers in 1995.

D . The project used two main remote-sensing techniques. The first is magnetometry, which works on the principle that magnetic fields at the surface of the Earth are influenced by what is

buried beneath. It measures localized variations in the direction and intensity of this magnetic field. " The Earth's magnetic field can vary from place to place, depending on what happened there in the past," says Branting. "if something containing iron oxide was heavily burnt, by natural or human actions, the iron particles in it can be permanently reoriented, like a compass needle, to align with the Earth's magnetic field present at that point in time and space.' The magnetometer detects differences in the orientations and intensities of these iron particles from the present day magnetic field and uses them to produce an image of what lies below ground.

E . Kirkenes Dag lends itself particularly well to magnetometry because it was all burnt at once in a savage fire. In places, the heat was sufficient to turn sandstone to glass and to melt granite. The fire was so hot that there were strong magnetic signatures set to the Earth's magnetic field from the time-around 547 BC resulting in extremely clear pictures. Furthermore, the city was never rebuilt. " if you have multiple layers confusing picture because you have different walls from different periods giving signatures that all go in different directions," says Branting. " We only have one going down about 1.5 meters, so we can get a good picture of this fairly short-lived city."

F . The other main sub-surface mapping technique, which is still being used at the site, is resistivity. This technique measures the way electrical pulses are conducted through sub-surface soil. It's done by shooting pulses into the ground through a thin metal probe. Different materials have different electrical conductivity. For example, stone and mudbrick are poor conductors, but looser, damp soil conducts very well. By walking around the site and taking about four readings per mrtre, it is possible to get a detailed idea of what is where beneath the surface. The teams then build up pictures of walls, hearths, and other remains. " It helps a lot if it has rained because the electrical pulse can get through more easily," Says Branting. "Then if something is more resistant, it really shows up." This is one of the reasons that the project has a spring season when most of the resistivity work is done. Unfortunately, testing resistivity is a lot slower than magnetometry. " If we did resistivity over the whole site it would take about 100 years," says Branting. Consequently, the team is concentrating on areas where they want to clarify pictures from the magnetometry.

G . Remote sensing does not reveal everything about Kerkenes Dag, but it shows the most interesting sub- surface areas of the site. The archaeologists can then excavate these using traditional techniques. One surprise came when they dug out one of the fates in the defensive walls. "Our observations in early seasons led us to assume that we were looking at a stone base from a mudbrick city wall, such as would be found at most other cities in the Ancient Near East," says Dr Summers. " when we started to excavate we were staggered to discover that the gate would have stood at least ten meters high. After ten years of study, Pteria is gradually giving up its secrets."

Questions 14-17

Reading Passage 2 has seven paragraphs, A-G.

Which paragraph contains the following information?

Write the correct letter, A-G, in boxes 14-17 on your answer sheet.

14 . The reason why various investigative methods are introduced.

15 . An example of an unexpected discovery.

16 . The methods to survey the surface of the site from above.

17 . The reason why experts want to study the site.

Questions 18-25

Summary

Complete the following summary of the paragraphs of Reading Passage, using no more than Three words from the Reading Passage for each answer. Write your answers in boxes 18-25 on your answer sheet.

Exploring the Ancient City of Pteria

The relevant work was done ten years ago. To begin with, experts took photos of the site from the ground and then from a distance in a .....18..... To find out what lay below the surface, they used two leading techniques. One was a magnetometer, which identifies changes in the magnetic field. These changes occur when the .....19..... in buried structures have changed direction as a result of great heat. They match with the magnetic field, which is similar to a .....20.....

The other one was resistivity, which uses a .....21..... to fire electrical pulses into the earth. The principle is that building materials like .....22..... and stone do not conduct electricity well, while .....23..... does this much better. Archaeologists preferred to use this technique during the....24.....when conditions are more favorable. Resistivity is mainly being used to .....25..... some images generated by the magnetometer.

Questions 26

Choose the correct letter, A, B, C or D.

Write the correct letter in box 26 on your answer sheet.

26 . How do modern remote-sensing techniques help at the site?

A . They avoid the need for experts to dig any part of the site.

B . They bring parts of the site into the light so that key areas can be researched further.

C . They show minute buried objects for the archaeologists to dig up.

D . They make the investigation more flexible as they can be used at any time of years.

Section-3

Right Whales

A . They dive 600 feet, brushing their heads along the seafloor with raised, wartlike patches of skin, something swimming upside down, big as sunken galleons, hot-blooded and holding their breath in cold and utter darkness while the greatest tides on Earth surge by. Then they open their cavernous maws to let the currents sweep food straight in. This is one way North Atlantic right whales feed in the Bay of Fundy between Maine, New Brunswick, and Nova Scotia. Or so the experts suspect, having watched the 40-to 80-ton animals surface with mud on their crowns. Mind you, they say, that could result from another activity-one nobody can imagine yet.

B . science calls these animals Eubalaena glacialis, "good, or true, a whale of the ice." Heavy irony is embedded in the common name, right whale, given by whalers who declared them the right whales to kill. favoring shallow coastal waters, they passed close to ports, swam slowly, and often lingered on the surface. Such traits made them easy to harpoon, and they tended to conveniently float after they died, thanks to their exceptionally thick blubber layer, which whalers rendered into oil. The first of the great whales to be hunted commercially, E. glacialis lit the lamps of the Old World from the Dark Ages through the Renaissance. By the 16th century, Europeans had exhausted the eastern North Atlantic population and turned to North America's coast. Their whalers set up stations in Labrador and took 25,000 to 40,000 related bowhead whalers along with an unknown number of rights (records seldom distinguished between these two similar looking titans).

C . By the time New Englanders got into the right-whale-killing business, they were chasing leftovers. The Yankees hunted down another 5,000 or so, partly because whales became even more prized for their baleen than for oil. Hundreds of strips of this tough yet flexible material, each six to nine feet long and finely fringed, drape from the upper jaw. They form a colossal sieve that allows the giants to strain tiny crustaceans from the water for food-a billion flea-size copepods a day to supply the minimum 4,00,000 calories an adult whale needs (the ratio of a whale body mass to its preys is 50 billion to one). Society, however, thought baleen was best used for corset stays, stiffeners in fashionable gowns, umbrella ribs, and (consider; "I'm going to whale on you!") horsewhips.

D . As the 20th century began, the number of whales left in this species was possibly in the low dozens. About 350 to 400 North Atlantic right whales exist today. The survivors migrate

along North America's East Coast between feeding grounds in the Gulf of Maine and wintering sites farther south roughly 1400 miles one way for pregnant females that journey to traditional calving areas off Georgia and Florida. They travel through an intensely urban stretch of ocean.

E . A research team from Boston's New England Aquarium spends the summer stationed in Lubec, Maine, studying the whales that gather to feed and socialize in the Bay of Fundy and nearby Roseway Basin, Off Nova Scotia's southern tip. The scientists, who whale in the population by its unique callosity pattern|(those wartlike patches on their heads), along with scars and other irregularities, and, increasingly, DNA samples. One of their favorites is #2223, first seen in these waters in 1992. It was a baby, and so fond of cavorting around boats that they named it Calvin after the mischief-loving cartoon kid., That same year a fisherman reported a calf circling its dying mother, and when the team recovered the carcass of the female, they identified her as #1223- Delilah, Calvin's mom. The eight-month-old calf's prospects looked grim, for it should have been nursing Delilah's rich, warm milk for several more months.

F . In July 1993 researchers poring over fresh photos from the bay found images that looked like a match for Calvin's baby pictures. Yes! The orphan had somehow made it alone. DNA from a skin sample taken in 1994 showed that curious, hardy Calvin was, in fact, a girl whale. Fertile adult females are the most valuable segment of the population. They number fewer than a hundred. Calvin seemed on the verge of adding one more to their ranks.

G . For three years running, the researchers gauged the young female's blubber thickness with ultrasound. It's a tricky operation. "One whaler's reaction jolted the skiff hard enough to send me flying overboard," Amy Knowlton of the research team recalled. Nevertheless, the researchers found Calvin growing pleasingly plump, a prime measure of health. On New Year's Eve of 1999, she was recorded for the first time in the Georgia Bight, an expanse of shallow coastal waters off Georgia and Florida, where right whales give birth. In summer of 2000 Calvin was once again in the Bay of Fundy, but this time she was snarled in fishing gear. Unbreakable polyblend ropes wrapped around her body, cut into the skin, and trailed in her wake, slowing her down. Then researchers lost sight of the young female.

H . Two to six right whales are found dead in a typical year, at least half of them killed by ship strikes or entanglement. Additional animals simple disappear. Since more than three-quarters of North Atlantic right whales bear scars from encounters with fishing gear, scientists wonder: How many of those missing are weighted down by ropes, nets or crab and lobster pots for months or even years, the fat reserve that help keep them buoyant dwindling as they starve, fighting harder to reach the surface for each breath, until they finally give in to pain and exhaustion and sink?

I . Months dragged by. Someone finally spotted Calvin in Cape Cod Bay during her hobbled journey back south. a disentanglement team from nearby Provincetown, Massachusetts, raced for the site and made two attempts to slice away her bindings. They couldn't get them all, but when Calvin was seen during 2001, she had worked free of the remnants.

J . The corridor traveled by Calvin and the other North Atlantic right whales has grown ever more crowded with fishing activities and busy shipping lanes. Plumes of contaminants flow from river mouths. and the underwater din of ship traffic probably makes it increasingly difficult for

the whales to communicate and keep track of one another. Though not as visible as wounds from boat prows and propeller blades or fishing gear webbed around struggling bodies, heavy chemical and noise pollution may take a gradual toll.

K . During the 1980s the number of babies born annually was around 12. The total twice fell sharply in the 1990s until just a single calf appeared in 2000. Since then, the average has risen to more than 20 calves a year. Yet this remains 30 percent below the whales' potential rate of reproduction. Why? If scientists are to guide the species' salvation, they need more data and more answers. Fast.

Questions 27-32

The reading passage has eleven paragraphs A-K.

Which paragraph contains the following information?

Write the correct letter A-K, in boxes 27-32 on your answer sheet.

NB you may use any letter more than once

27 . A new and more profitable commercial finding of right whales.

28 . The change of birth rate.

29 . The migratory route of right whales.

30 . The reason why right whales are easy to catch.

31 . The methods to distinguish each right whale.

32 . Right whales living environment at present.

Questions 33-40

The scientists have studied right whales by setting up a (n).....33..... One of their interests is a whale named .....34..... who lost its mum when it was very young. Scientists were worried about the baby whale's future until it appeared again in .....35..... later, it was found to be ....36..... being precious in the species. It was quite .....37....., which was the main symbol of health. Unfortunately, in summer of 2000, it was discovered being twisted in .....38..... like Polyblend ropes, and then disappeared. When it was seven months later, people tried to .....39..... parts of .....40..... wrapping round its body, which were cleared during the next year.