READING PASSAGE 1

Answer **Questions 1–13**, which are based on Reading Passage 1 on pages 2 and 3.

Traffic Jams

Nobody likes traffic jams, yet they have been one of the plagues of life since at least Roman times. Why is this so? The short explanation is that they take place whenever more people want to use a given transportation facility than it can handle. Yet there is clearly more to the story than the simple bottleneck. Why do so many traffic jams seem to come out of nowhere?

A

Mathematicians, physicists and computer programmers have been trying to disentangle traffic jams for decades. Traffic-flow theory had its beginnings in the 1930s, the first computer simulations of traffic were designed in the 1950s, and theoretical breakthroughs have followed regularly in every decade since. In the 1980s and '90s, as computers became exponentially faster, new models of traffic flow employing analytical methods based on, for example, non-linear dynamics and statistical physics, were developed.

B

Most traffic is tied to predetermined patterns: the rush hour, the weekend exodus, the holiday getaway. So, in rudimentary computer models of traffic flow, everyone leaves home at a predetermined time, everyone knows exactly what route to take and so forth. Many recent models, however, throw a bit of human capriciousness into the equation: their virtual people accelerate at different speeds from day to day, for instance, or they do not always change lanes in the same circumstances. Radically different traffic patterns can result.

C

Traffic often appears chaotic: virtually imperceptible changes can give rise to large effects. Ironically, computer simulations suggest that traffic is most sensitive to disturbances when it is flowing most efficiently. Both an empty system and a gridlocked system are easy to predict, but a stream of cars hurtling at top speed along a highway is highly unpredictable, and it can become ensnarled simply as a result of the speed. Would you prefer a trip to the airport in a definite thirty minutes, or a faster route that usually takes twenty minutes except every tenth time, when it takes two hours?

D

The laws governing spontaneous traffic jams are dismayingly fundamental: even grains of sand falling down a glass tube can form traffic jams, as investigators in Germany have shown. The mathematics of granular flow and of water flowing down a river is very similar to the mathematics of traffic flow. It is not yet clear, however, to what extent spontaneous jams play a role in everyday traffic. Computer simulations confirm that most jams are caused by tunnels, construction sites and other simple reasons.

E Once drivers are caught in a jam, they almost always exacerbate the problem. The road beyond the jam may be wide and clear, but the number of cars accelerating away from the jam every hour in every lane will usually be far less than the lane capacity. Recent research suggests the cause is quite straightforward: people are sloppy about getting their cars back up to speed. Even if drivers take an average of three seconds to get going - only a second more than the typical reaction time - only 1,200 will leave the jam after an hour while 1,800 will join it. The damage has been done.

F A familiar scenario: the freeway becomes like a parking lot, so transportation planners add a new lane, and traffic flows more freely. For a while everybody is happy: people get home faster. But then a few people realise they now have time to stop off at home, after work, before going shopping. Others recognise that they can live farther away from the city, on a larger plot, without increasing their commuting time. Soon the congestion builds up. This 'induced travel' may be the hardest element of transportation to model. Erratic as drivers may be, driving is heavily constrained by physics: a car occupies a fixed amount of space, and can accelerate and brake only so fast. The wish for travel, by contrast, can be entirely whimsical.

G Research has shown that cities could build their way out of congestion, but the results might not be places where many people would want to live. In any event, congestion is a poor measure of the efficiency of a transportation system. Are you better off in a congested city such as New York, where you can walk to five movie theatres in ten minutes, or in a relatively uncongested city such as Santa Fe, New Mexico, where you drive to five movie theatres in twenty minutes? Congested cities can be more convenient than uncongested cities. And perhaps in trying to solve the problem of congestion we are actually on a fool's mission.

Questions 1-7

Reading Passage 1 has seven paragraphs, A-G.

Which paragraph contains the following information?

Write the correct letter, A-G, in boxes 1-7 on your answer sheet.

1. a list of common peak traffic periods
2. a comparison between the movement of traffic and other types of movement that occur in the natural world
3. an advantage of places where there is a lot of traffic
4. a historical overview of methods used to understand how traffic moves
5. an example of a short-lived solution to a traffic problem
6. a reason why smooth-flowing traffic is more unstable than slow-moving traffic
7. a reason why traffic jams last longer than might be expected

Questions 8-12

Do the following statements agree with the information given in Reading Passage 1?

In boxes 8-12 on your answer sheet, write

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

8. Computer models of traffic problems were first developed in the 1980s and '90s.
9. Traffic has increased because people take more holidays than they used to.
10. Small changes in driver behaviour can cause big changes in traffic flow.
11. Traffic that is moving well is unlikely to have any problems.
12. Most Americans would rather drive in New Mexico than New York.

Question 13

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

Write the correct letter in box 13 on your answer sheet.

The main purpose of the writer of this article is to

A. present opposing views on the analysis of traffic congestion.

B. analyse the reasons why traffic flow has increased.

C. encourage drivers to prevent traffic problems.

D. explain why traffic jams are unavoidable.