Questions 15-29. Read the following passage carefully before you choose your answers.

(This passage is from a book about clouds. Contrails are airborne streaks of condensed water vapor created by aircrafts.)

One paper, published in 2004,[1] looked at the increase in observed cirriform clouds over the US between the years 1974 and 1994. [The paper] . . . concluded that the increase in air traffic and its resulting contrails had led to increasing cirriform cloud cover. Estimations of the expected warming effects of this increase were equivalent to .36°F per decade. Amazingly, the effect of the increase in cirriform clouds alone was considered sufficient to account for almost the entire rise in temperatures across the USA during the last 25 years. This is a major claim, for though it relates to localised warming effects, not global ones, the report suggests that the high clouds that develop from contrails are a huge contributor to surface warming.

Another key paper, published in 2003,[2] was equally sobering. Here, the scientists correlated the changing distribution of cirriform clouds over Europe from weather satellite images with precise records of the varying concentrations of air traffic during the same periods. The report concluded that the warming attributable to cirriform clouds appearing to develop as a result of air traffic was ten times greater than that expected to result from aviation CO_2 emissions.

Now, it is hard to make a meaningful comparison between the environmental impacts of such differing factors as, on the one hand, aircraft CO_2 emissions, which remain in the atmosphere for over a hundred years and have a cumulative and global effect on surface warming and, on the other hand, aviation-induced cloud cover, whose warming effects are both localised and temporary. But these studies suggest that aviation's contrails are leading to other high clouds that are a more significant factor in global warming than its CO_2 emissions.

Air traffic is estimated to be increasing by five percent a year,[3] with most of the increase being in contrail-forming long-haul flights. Ironically, modern aircraft engines—designed to burn more efficiently and so emit less CO_2—actually create more contrails.

A team of scientists at Imperial College in London has been looking at one possible way to reduce contrails: stopping aircraft from flying so high.

Using computer simulations designed for air-traffic management, they have considered the implications of imposing restrictions on European cruising altitudes to keep aircraft below contrail-forming levels.[4] One problem with such a system is that the lower an airplane flies, the denser the air it has to travel through and so the more fuel it needs to burn—something that has financial implications as well as those of increased greenhouse gas emissions.

So the team evaluated a system that imposed the highest possible 'contrail-free' ceiling on cruising altitudes, which could be calculated dynamically in response to changes in atmospheric temperature and humidity.

'If you had that cap on the flights in Europe—' explained Dr. Bob Noland, one of the scientists behind the project, 'which would result in a four percent increase in CO_2 emissions from increased fuel consumption—our conclusion was that the reduction in contrails would make it a good policy.' Their findings suggested that, though there would certainly be implementation difficulties, such as increased congestion and longer flight times, the system could reduce contrail formation by between 65 and 95 percent, compared with just a four percent rise in CO_2 emissions.

Without the contrails it seems that there would be a considerable reduction in the overall amount of thin, ground-warming cirriform clouds. 'The CO_2 emissions from aircraft,' says Noland, 'while significant and growing, are not going to make that much difference even if we cut them down, but if we reduce contrails by 90 percent tomorrow—which we think is entirely feasible—you would get a major impact right away. Stopping the contrails would bring an immediate benefit.'

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1 Minnis, P.; Ayers, J. K.; Palikonda, R.; Phan, D.: 'Contrails, Cirrus Trends, and Climate'. 2004, *Journal of Climate*, 17.

2 Mannstein, H. & Schumann, U.: 'Observations of Contrails and Cirrus over Europe'. Proceedings of the AAC Conference, 30 June–3 July 2003, Friedrichshafen, Germany.

3 *IPCC Special Report on Aviation and the Global Atmosphere*, 1999.

4 Williams, V. & Noland, R. B.: 'Variability of contrail formation conditions and the implications for policies to reduce the climate impacts of aviation', not yet published.

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15. The primary goal of the passage is to

(A) compare two recent scientific studies on global warming
(B) explore the relationship of air traffic to atmospheric temperatures
(C) argue for the necessity of limiting air travel in Europe
(D) review a chronological series of studies on cirriform clouds
(E) examine research methods used to gauge atmospheric temperatures

16. According to the passage, the relationship between aircraft contrails and cirriform clouds is best expressed by which of the following?

(A) Aircraft contrails decrease the number of cirriform clouds that form.
(B) Aircraft contrails have no significant impact on the number of cirriform clouds that form.
(C) Aircraft contrails increase the number of cirriform clouds that form.
(D) Aircraft contrails are only one of many sources of cirriform clouds.
(E) No conclusive evidence exists about the relationship between aircraft contrails and cirriform cloud formation.

17. In the first paragraph (lines 1-15), the author relies on which of the following to establish credibility?

(A) Concession to an opposing view
(B) Data from a scientific study
(C) Details of the procedure for a particular experiment
(D) Conclusions agreed to by all scientists
(E) Ad hominem arguments

18. The function of the note in line 1 is to

(A) document the specific source for an empirical claim
(B) offer an explanation of what is meant by a term
(C) prove that the author used print as well as online sources
(D) redirect a discussion begun in the body of the paper cited
(E) establish the credibility of one source at the expense of another

19. The word "Amazingly" (line 8) emphasizes the author's

(A) confusion about the research data
(B) dismay that nothing has been done to reduce the number of contrails
(C) surprise at the conclusion of a study
(D) excitement about the sophistication of scientific instruments
(E) frustration with the methodology used in a study

20. The author states "This is a major claim" (lines 11-12) in order to

(A) expose the logical fallacy of a popular argument
(B) explore ways in which global warming is a localized phenomenon
(C) challenge the view of those who feel that the claim is unsubstantiated
(D) call attention to a claim by highlighting its importance
(E) validate the counterclaim that temperatures have not risen in the last 25 years

21. The author's strategy in paragraph three (lines 25-35) can best be described as presenting a

(A) generalization that is substantiated by a detailed example
(B) problem followed by a particular recommendation
(C) controversial proposal followed by a counterproposal
(D) qualifying statement that is modified by a following statement
(E) summary followed by a disclaimer

22. The author's tone in paragraph three (lines 25-35) can best be described as

(A) strident
(B) disbelieving
(C) relieved
(D) uncertain
(E) reasoned

GO ON TO THE NEXT PAGE.