READING PASSAGE 1

You should spend about 20 minutes on **Questions 1-14** which are based on Reading Passage 1 below.

Pest Control ++++++++++++++++++++++

A. In 1476, the farmers of Berne in Switzerland decided that there was only one way to rid their fields of the cutworms attacking their crops. They took the pests to court. The worms were tried, found guilty and excommunicated by the archbishop. In China, farmers had a more practical approach to pest control. Rather than rely on divine intervention, they put their faith in frogs, ducks and ants. Frogs and ducks were encouraged to snap up the pests in the paddies and the occasional plague of locusts. But the notion of biological control began with an ant. More specifically, it started with the predatory yellow citrus ant, Oecophylla smaragdina, which has been polishing off pests in the orange groves of southern China for at least 1700 years. The yellow citrus ant is a type of weaver ant, which binds leaves and twigs with silk to form a neat, tent-like nest. In the beginning, farmers made do with the odd ants nest here and there. But it wasn't long before growing demand led to the development of a thriving trade in nests and a new type of agriculture—ant farming.

B. Citrus fruits evolved in the Far East and the Chinese discovered the delights of their flesh early on. As the ancestral home of oranges, lemons and pomelos, China also has the greatest diversity of citrus pests. And the trees that produce the sweetest fruits, the mandarins—or kan—attract a host of plant-eating insects, from black ants and sap-sucking mealy bugs to leaf-devouring caterpillars. With so many enemies, fruit growers clearly had to have some way of protecting their orchards.

C. The West did not discover the Chinese orange growers' secret weapon until the early 20th century. At the time, Florida was suffering an epidemic of citrus canker and in 1915 Walter Swingle, a plant physiologist working for the US Department of Agriculture, was sent to China in search of varieties of orange that were resistant to the disease. Swingle spent some time studying the citrus orchards around Guangzhou, and there he came across the story of the cultivated ant. These ants, he was told, were "grown" by the people of a small village nearby who sold them to the orange growers by the nestful. Whole orchards can be colonized by securing a nest on one tree and then connecting it to adjacent trees with bamboo strips. The strips serve as bridges for the ants to build new nests in nearby trees.

D. The earliest report of citrus ants at work among the orange trees appears in a book on tropical and subtropical botany written by Hsi Han in AD 304. "The people of Chiao-Chih sell in their markets ants in bags of rush matting. The nests are like silk. The bags are all attached to twigs and leaves which, with the ants inside the nests, are for sale. The ants are reddish-yellow in colour, bigger than ordinary ants. In the south if the kan trees do not have this kind of ant, the fruits will all be damaged by many harmful insects, and not a single fruit will be perfect."

E. The long tradition of ants in the Chinese orchards only began to waver in the 1950s and 1960s with the introduction of powerful organic insecticides. Although most fruit growers switched to chemicals, a few hung onto their ants. Those who abandoned ants in favour of chemicals quickly became disillusioned. As costs soared and pests began to develop resistance to the chemicals, growers began to revive the old ant patrols. They had good reason to have faith in their insect workforce. Research in the early 1960s showed that as long as there were enough ants in the trees, they did an excellent job of dispatching some pests—mainly the larger insects—and had modest success against others. Trees with yellow ants produced almost 20 per cent more healthy leaves than those without. More recent trials have shown that these trees yield just as big a crop as those protected by expensive chemical sprays.

F. A major problem with citrus ants in some areas is that they cannot survive the winter, unless nests are collected and the ants fed. Nonetheless, it has been reported that in the Jianmei region of Huaan district, ants were able to survive the winter without any intervention from growers, having become a permanent and integral part of the orchard ecosystem. Interestingly, the ant nests that survived best were those located in the pomelo trees, which gave better protection than orange trees because of their large size and thick foliage. The nests that survived cold weather then provided the critical mass of ants to multiply and build new nests in the orange trees in the spring. Researchers suggested moving ant nests from orange trees to pomelo trees before harvesting oranges, a procedure that has worked well in establishing the citrus ant as the biological control of insect pests in the mixedorange-pomelo orchards in Huaan district. Chinese researchers conclude that perhaps the "intercropping" of orange trees with another tree that can shelter the ants in winter can be applied to other areas in China as well.

G. One apparent drawback of using ants—and one of the main reasons for the early skepticism by Western scientists—was that citrus ants do nothing to control mealybugs, waxy-coated scale insects which can do considerable damage to fruit trees. In fact, the ants protect mealybugs in exchange for the sweet honeydew they secrete. The Chinese orange growers always denied this was a problem but Western scientists thought they knew better. Research in the 1980s suggests that the Chinese were right all along. Where mealybugs proliferate under the ants protection they are usually heavily infected with parasites and this limits the harm they can do.

H. Orange growers who rely on carnivorous ants rather than poisonous chemicals maintain a better balance of species in their orchards. While the ants deal with the bigger insect pests, other predatory species keep down the numbers of smaller pests such as scale insects and aphids. In the long run, ants do a lot less damage than chemicals—and they're certainly more effective than excommunication.

Questions 1-6

Do the following statements agree with the information given in Reading Passage 1? In boxes **1-6** 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.

1. China has more orange pests than any other country in (he world.
2. Walter Swingle was sent to China by US agricultural authorities to study pest control techniques with ants.
3. The costs of protecting orchards with chemical sprays became higher.
4. Trees without ants had more leaves fall than those with.
5. Chinese' approach of using ants impressed American scientists.
6. Citrus trees protected by ants suffer from another kind of pest.

Questions 7-10

Use the information in the passage to match the years and events taking place in them.
Write the appropriate letter **(A-D)** in boxes **7-10** on your answer sheet.

7. A western agronomist visited China.
8. Florida suffered from citrus canker disease.
9. first record of anls used for pest control
10 Chinese farmers gave up ants for pesticides.

A	**Mid 20th century**
B	**910**
C	**Early 4th century**
D	**1915**

Choose **NO MORE THAN THREE WORDS** from the passage to complete the summary below.

To help ants survive the winter, researchers studied the case of Jianmei, Huaan, where ants did survive with no human ….**11** …… at all. They discovered as a result that…**12** ……provide ants with more desirable shelters over winter thanks to their dense leaves, so that ants are able to reproduce quickly in nearby ……**13**……when spring conies. They thus suggest that orange trees be ……**14** ……with pomelo trees and this technique he introduced to other parts of China.

READING PASSAGE 2

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

Questions 15-21

Reading Passage 1 has **8 paragraphs A- H.**
From the list of headings below choose the 7 most suitable headings for **paragraphs A, B, C, E, F, G**, and **H**.
Write the appropriate numbers **(i- x).**

NB *There are more headings than paragraphs, so you will not use them all.*

List of Headings

i	Fuel cells vs. ordinary battery
ii	Fuel cell provides solution to NASA's dilemma
iii	Historical view of fuel cell
iv	Hydrogen as the staple type; of its energy source
v	Widespread recognition as a future source of energy
vi	Fuel cell buses and cars
vii	Direct conversion substantially improves efficiency
viii	The electrochemical process happening in a fuel cell
ix	NASA's contribution to fuel cell technology
x	Potential for further commercialization

15	**Paragraph A**
16.	**Paragraph B**
17.	**Paragraph C**
18.	**Paragraph E**
19.	**Paragraph F**
20.	**Paragraph G**
21.	**Paragraph H**

A. The easiest way to understand fuel cells is to think of them as a cousin to the ordinary battery. Both produce electricity through electrochemical reactions. The difference lies in a fuel cell's ability to constantly produce electricity as long as it has a source of fuel where a battery needs to be recharged. Consequently, since a fuel cell does not store energy internally, a fuel cell will not "run down" like a battery. Fuel cells directly convert the fuel into electricity where a battery has to replenish its electricity from an external source.

B. The fuels utilized by a fuel cell to generate electricity are hydrogen and oxygen. Hydrogen, the most abundant element on Earth, is rarely (bund in its pure form. Most fuel cell systems employ a component called a reformer to extract hydrogen from hydrogen rich fossil fuels. The by- products of this process are carbon dioxide, less than half the amount generated by traditional electricity generation methods, and trace amounts of nitrous oxide. The hydrogen purity requirement and the need for reforming are dependent on the type of fuel cell stack, employed.

C. The by-products of the electrochemical reaction that occurs in a fuel cell are electricity, water vapor and heat. heoretically, the water vapor can be recycled to produce additional hydrogen. The waste heat can be utilized for heating water, space hearing and cooling. The direct conversion of fuel into electricity allows fuel cells to achieve substantially higher efficiencies

than combustion, which is limited by Carnot's Law of Thermodynamics. Fuel cells achieve efficiencies of 35% to 90% depending on whether the waste heat is employed. These efficiencies are about 2 to 3 times higher than a combustion engine which converts fuel to heat, then into mechanical energy and finally into electricity.

D. In order to provide an example of the electrochemical process that occurs in a fuel cell, the following describes the chemical reactions in a typical proton exchange membrane (PEM) fuel cell. Once the fuel has been reformed into hydrogen, the fuel cell combines oxygen, from the surrounding atmosphere, and hydrogen to generate electricity and water. The hydrogen is fed into the anode side of the cell where it encounters a catalyst. The catalyst strips the negatively charged electrons from the hydrogen, which are then routed out of the cell through an external circuit (i. c. light bulb, house, motor, etc...). The hydrogen ions (H + } travel through the electrolyte contained in the fuel cell until they reach the cathode. Once at the cathode, the hydrogen ion (H +) , the electron that traveled through the external circuit and the oxygen molecule join together.

E. The fuel cell can trace its roots back to the ISOO's. A Welsh bom, Oxford educated barrister named Sir William Robert Grove realized that if electrolysis, using electricity, could split water into hydrogen and oxygen then the opposite would also be true. Combining hydrogen and oxygen, with the correct method, would produce electricity. To test his reasoning, Sir William Robert Grove built a device that would combine hydrogen and oxygen to produce electricity, the world's first gas battery, later renamed the fuel cell. His invention was a success, and Grove's work advanced the understanding of the idea of conservation of energy and reversibility. Interest in Grove's " gas battery diminished as the dawn of cheap fossil fuels approached and the soon to be discovered steam engine captivated the present day society.

F. In the 1960's, the National Aeronautics and Space Administration (NASA) undertook the first step in maturing fuel cell technology. It was then developing the mission critical systems for the first prolonged manned flight into space. Batteries were ruled out due to the size, weight and toxicity. The once obscure fuel cell became the technological solution to NASA's dilemma of how to provide power for extended missions to space. The earlier problems of cost and fuel supplies that plagued fuel cells became irrelevant as the spacecraft was already carrying liquid hydrogen and oxygen. An additional benefit of fuel cells over other technology was that the astronauts could consume the fuel cell's water by-product. On each subsequent mission the fuel cells became increasingly reliable and today NASA's space shut de relies on fuel cells for electricity and drinking water once in orbit.

G. NASA and the space program provided fuel cells with the initial research and development the technology required. Since their adoption by the space program, fuel cell technology has achieved widespread recognition by industry and government as a clean energy source for the fuhire. With this in mind, the amount of interest in fuel cells has expanded exponentially.Today, billions of dollars have been spent on research and the commercialization of fuel cell products. Fuel cell bus has proved to be a milestone. Ballard Power Systems* fleet of 33 Mercedes-Benz Citaro fuel cell buses currendy operating in Europe, Iceland and Australia has surpassed one million kilometers of service. The buses have carried more than four million passengers. Ford's hydrogen-powered car made its debut in 2000 and its latest Focus FCV is found impressive at Michelin Bibendum Challenge, an annual gathering of alternatively-fuel led vehicles. Powered by a 115 bhp Ballard 902 fuel-cell stack, Focus FCV is fed by hydrogen stored in a 184-litre tank secreted below the rear seats. Even so, the car still has a thick-ankled 1600 kg kerb weight a full 400 kg heavier than your average petrol-powered Focus and its range is limited to 200 miles.

H. Over the next couple of years, the products that have been in the commercialization process will begin to be available to consumers. Chemists at Arizona State University have created a tiny hydrogen-gas generator that diey say can be developed into a compact fuel cell package that can power your laptop computer, digital camera, portable music player and other electronic devices. " We're trying ro maximize the usable hydrogen storage capacity in order to make this fuel cell power source last longer," says smdy leader Don Gervasio.

Do the following statements agree with the information given in Reading Passage 1? In boxes **22-26** 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.

22. Interest boomed in Grove's gas batten- as it gained success.
23 NASA opted for the fuel-cell to power its spacecrafts because it's non-toxic and thus safer to astronauts than batteries.
24. A hydrogen and oxygen fuel supply had always been fuel cells' weakness*
25. The application of fuel cell technology so far lias been more successful in public transport than in private automobiles.
26 Ford's launched its first hydrogen-powered car at the Michel in Hihendum. Challenge.

Question 27

Choose the correct letter, **A, B, C, D**, or **E**. Write your answer in box **27** on your answer sheet.
Which of the following is the most suitable title for Reading Passage 2'

A Energy Conversion
B Potential of Hydrogen Power
C Fuel Cell Utilization in Space Exploration
D Fuel Cell Cars
E Fuel Cell Fact and Future

READING PASSAGE 3

You should spend about 20 minutes on **Questions 28 - 40** which are based on Reading Passage 3 below.

S E T I

Part A The Search for Extraferrestrial Intelligence (SET!) is conducted by dedicated scientists everyday. In the movie Confacf, Jodie Foster's character, Blie Arroway, searches the heavens with several large radio telescopes. When she receives a radio message from a distant star, there are profound implications for humanity. Modern SETI efforts began with a paper written by physicists Giuseppe Cocconi and Philip Morrison and published in the science press in 1959. Since then, SETI has been an extremely controversial scientific endeavor. Some scientists believe that it is a complete waste of time and money, while others believe that detection of a signal from ET would forever change our view of the universe.

The idea that life, especially life with intelligence, might exist in other parts of the universe is a very old one. Early ideas were based on an intuitive belief in the enormity of the universe and in what is now called the mediocrity principle, namely that there is nothing special about the Sun, the Earth, and the human race. Present ideas are also based on the mediocrity principle supported by the universality of the laws of physics and chemistry, and by the enormity of the universe. The chemical evolution, that is, the natural formation of complex organic compounds that led to the origin of life on Earth is quite common in the universe.

Part B SETI is not generally viewed by scientists as a trivial task. Our galaxy, the Milky Way, is 100,000 light years across and contains approximately a hundred billion slars. Searching the entire sky for some far-away and faint signal is an exhausting exercise. A number of assumptions are needed for SET! to be feasible. A basic assumption of SETI is that of "mediocrity": the idea that humanity is not privileged in the cosmos but in a sense "typical" or "medium" when compared with other intelligent species. This would m« thai humanity has sufficient similarities with other intelligent beings and that communications would be mutually desirable and understandable. If this basic assumption of mediocrity is correct, and other intelligent species are present in any number in the gaiaxy at our technological level or above, then communications between the two worlds should be inevitable.

Another assumption is to focus on sun-like stars. Very big stars have relatively short lifetimes, meaning that intelligent life would likely not have time to evolve on planets orbiting them. Very small stars provide so tittie heat and warmth that only planets in very close orbits around them would not be frozen solid, and in such close orbits these planets would be tidally locked to the star, with one side of the planet perpetually baked and the other perpetually frozen. About 10% of the stars in the Milky Way galaxy are sunlike, and there are about a thousand such stars within 100 light-years of the Sun. These stars would be useful primary targets for interstellar listening. However, we know of only one planet where life exists, our own. There is no way to know if any of the simplifying assumptions are correct, and so as a second priority the entire sky must be searched.

Part C The search for extraterrestrial intelligence was initiated only after the development of radio astronomy and large radio telescopes. Visiting another civilization on a distant world is presently beyond human capabilities. Distances between the stars are unimaginably vast, and our most advanced ideas for space rockets, such as light propulsion, nuclear propulsion, solar sails and matter-antimatter engines, are many years away from becoming reality. However, it is currently technologically feasible to develop a communications system which uses a powerful transmitter and a sensitive receiver to search the sky for extraterrestrial worlds whose citizens have a similar inclination as terrestrials.

In order to find an electromagnetic transmission from an alien civilization we also have to search through most of the useful radio spectrum, as there is no way to know what frequencies aliens might be using. Trying to transmit a powerful signal over a wide range of wavelengths is impractical, and so it is likely that such a signal would be transmitted on a relatively narrow band, Cocconi and Morrison suggested that the microwave frequencies between 1 and 10 gigahertz would be best suited for interstellar communications. Below 1 gigahertz, galactic magnetic fields tends to drown out other radio sources. Above 10 gigahertz, radio noise from water and oxygen atoms in our atmosphere tends to also become a source of interference. The low end of this "microwave window" is particularly attractive for communications, because it is in general easier to generate and receive signals at lower frequencies. The lower frequencies are also desirable because of the Doppler shifting of a narrow-band signal due to planetary motions.

Part D In 1960, Cornell University astronomer Frank Drake performed the first modern SETI experiment, named "Project Ozma". Drake used a 25-meter-diameier radio telescope at Green 99Bank, West Virginia, to examine the stars Tau Ceti and Epsilon Eridani near the 1.420 gigahertz marker frequency. In 1971, the U.S. National Aeronautics and Space Administration (NASA) funded a SETI study that involved Drake, Bernard Oliver of Hewlett-Packard Corporation, and others. The report that result J proposed the construction of an Earth-based radio telescope array with 1,500 dishes, known as "Project Cyclops". The OSU SETI program gained fame on August 15,1977 when Jerry Ehman, a project volunteer, witnessed a startlingly strong signal received by the telescope. He quickly circled the indication on a printout and scribbled the phrase "Wow!" in the margin. This signal, dubbed the "Wowl" signal, is considered by some to be the most likely candidate from an artificial, extraterrestrial source ever discovered, but it has not been detected again in several additional searches.

At least 60 radio searches have been carried out, and three radio observatories search continuously for radio signals. The results continue to be negative, however, it appears that the public is greatly interested in SETI research, and the future of SETI looks

bright. We are currently at a time when our technology has advanced enough for us to detect signals from ET and even broadcast our own signals to the stars, with the advancements in technology and the increasing interest in SETI, we may be close to finding the answer to that age-old question:" Are we alone in the universe, or are there ETs out there?"
Which part of the passage contains the following information? Write the appropriate letters i-iv in boxes 28-31 on your answer sheet.

i Widespread public interest and a promising future
ii Technological prerequisites for its implementation
iii Basic assumptions underlying SETI research
iv Former and current ideas about a controversial scientific endeavor

28. Part A
29 Part B
30. Part C
31. Part D

Questions 32-34
Answer the following questions **USING NO MORE THAN THREE WORDS** from the passage.

32. How do modern scientists conduct SETI?
33. What are previous beliefs in the enormity of the universe presently known as?
34. How many stars are would-be major targets for the SETI search?

Questions 35-40
Do the following statements agree with the information given in Reading Passage 3?
In boxes **35-40** 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.

35. Communication with lligent alien beings is desired only by humanity.

36. Modem SETI interests and efforts spurred the invention of radio telescopes.

37. It is unfeasible to send radio signals at various wavelengths.

38. The report by Drake and Oliver resulted in the construction of " Project Cyclops" , a radio telescope array.

39. The "Wow "'signal is the only case of communication from an extraterrestrial source.

40. Sixty radio searches have been earned out to broadcast our own signals to the stars.