READING PASSAGE 1

You should spend about 20 minutes on **Questions 1-13** which are based on Reading Passage 1 below.

A Brief History of Rubber

A

Rubber is one of the most important products to come out of the rainforest. Though indigenous rainforest dwellers of South America have been using rubber for generations, it was not until 1839 that rubber had its first practical application in the industrial world. In that year, Charles Goodyear accidentally dropped rubber and sulfur on a hot stovetop, causing it to char like leather yet remain plastic and elastic. Vulcanization, a refined version of this process, transformed the white sap from the bark of the Heave tree into an essential product for the industrial age.

B

With the invention of the automobile in the late 19th century, the rubber boom began. As demand for rubber soared small dumpy river towns like Manaus, Brazil, were transformed into over night into bustling centers of commerce. Manaus, situated on the Amazon where it is met by Rio Negro, became the opulent heart of the rubber trade. Within a few short years Manaus had Brazil's first telephone system, 161 miles of streetcar tracks, and an electric grid for a city of a million, though it had a population of only 40,000.

C

The opulence of the rubber barons could only be exceeded by their brutality. Wild Heave trees, like all primary rainforest trees are widely dispersed, with an adaptation that protects species from the South American leaf blight which easily spreads through and decimates plantations. Thus to make a profit, barons had to acquire control over huge tracts of land. Most did so by hiring their own private armies to defend their claims, acquire new land, and capture native laborers. As the Indians died, production soared.

D

The Brazilian rubber market was crushed by the rapid development of the more efficient rubber plantations of Southeast Asia. However, the prospects of developing plantations did not begin on a high note. Rubber seeds, rich with oil and latex, could not survive the long Atlantic journey from Brazil. Finally, in 1876, an English planter, Henry Wickham, collected 70,000 seeds and shipped them to England. 2800 of the seeds germinated and were sent to Colombo, Ceylon (present day Sri Lanka). After several false starts, including one planter in northern Borneo who felled his plantation after finding no rubber balls hanging from the braches, the prospects were grim. One major obstacle was the success of tea and coffee gave planters no reason to try an untested crop.

E

Finally in 1895, Henry Ridley, head of Singapore's botanical garden, persuaded two coffee growers to plant two acres of Heave tress. Twelve years later more than 300,000 ha of rubber grew in plantations in Ceylon and Malaya. New innovations increased efficiency and production doubled every two years. Rubber could be produced at only a fraction of the cost of collecting wild rubber in Brazil. By 1910, Brazilian production had fallen to 50%. In 1914, Brazil's market share was down around 30%; 1918 -20%, and 1940 -1.3%.

F

However the Second World War threatened to shift the rubber wealth. With Japan occupying prime rubber producing areas in Southeast Asia, the US feared it would run out of the vital material. Every tire, hose, seal, valve, and inch of wiring required rubber. The rubber Development Corporation, the chief overseer of rubber acquisition, sought out other sources including establishing a rubber program that sent intrepid explorers into the Amazon seeking rubber specimen that would be used to produce high yields, superior product, and possibility of resistance against leaf blight. The ultimate goal of the program was to establish rubber plantations close to home. In addition to searching the Amazon and establishing experimental plantations in Latin America, the program came up with some novel plans to produce rubber. Extensive work on synthetic rubber yielded a product that, in time, economists predicted would replace natural rubber. By 1964 synthetic rubber made up 75% of the market.

G

However the situation changed drastically with the OPEC oil embargo of 1973 which doubled the price of synthetic rubber and made oil consumers more conscious of their gas mileage. The concern over gas mileage brought unexpected threat to the synthetic market: the wide-spread adoption of the radial tire. The radial tire replaced the simple bias tires (which made up 90% of the market only 5 year earlier) and within a few years virtually all cars were rolling in radials. Synthetic rubber did not have the strength for radials; only natural rubber could provide the required sturdiness. By 1993 natural rubber had recaptured 39% of the domestic market. Today nearly 50% of every auto tire and 100% of all aircraft tires are made of natural rubber. 85% of this rubber is imported from Southeast Asia meaning that the US is highly susceptible to disruptions caused by an embargo or worse, the unintentional or intentional introduction of leaf blight into plantations. None of the trees in plantations across Southeast Asia has resistance to blight so a single act to biological terrorism, the systematic introduction of fungal spores so small as to be readily concealed in a shoe, could wipe out the plantations, shutting down production of natural rubber for at least a decade. It is difficult to think of any other raw material that is as vital and vulnerable.

Questions 1-7

Reading Passage 1 contains 7 paragraphs **A-G**.

Which paragraphs state the following information?

*Write the appropriate letters **A-G** in boxes **1-7** on your answer sheet.*

1 The extensive acceptance of radial tires.

2 Searching for new specimens to overcome leaf blight

3 The first trading center for the rubber business.

4 Asia dominated the rubber market year by year

5 Rubber seeds are vulnerable to long distance transport

6 Individual wealth accumulated by rubber trading

7 Natural rubber gave way to its replacement

Questions 8-13

Complete the summary below based on paragraph G

Use **NO MORE THAN THREE WORDS** from the passage for each answer.

OPEC doubled revenue from synthetic rubber and made oil consuming nations more attentive of **8** _____. This brought threats to the synthetic market by espousing the **9** _____, which would replace all the simple bias tires within a few years. Because **10** _____ is the only material that provides the entailed toughness, synthetic rubber lost significant market share. The US industry is very fragile to disruptions caused by an **11** _____. What's even worse, since the rubber trees in plantations across Southeast Asia cannot withstand **12** _____, the small fungal spores could be so dangerous as to shut down production of natural rubber for a decade. Rubber, hence, is the most **13** _____ raw material in the world.

READING PASSAGE 2

You should spend about 20 minutes on **Questions 14-26** which are based on Reading Passage 2 below.

Tackling Hunger in Msekeni

A

There are not enough classrooms at the Msekeni primary school, so half the lessons take place in the shade of yellow-blossomed acacia trees. Given this shortage, it might seem odd that one of the school's purpose-built classrooms has been emptied of pupils and turned into a storeroom for sacks of grain. But it makes sense. Food matters more than shelter.

B

Msekeni is in one of the poorer parts of Malawi, a landlocked southern African country of exceptional beauty and great poverty. No war lays waster Malawi, nor is the land unusually crowded or infertile, but Malawians still have trouble finding

enough to eat. Half of the children under five are underfed to the point of stunting. Hunger blights most aspects of Malawian life, so the country is as good a place as any to investigate how nutrition affects development, and vice versa.

C

The headmaster at Msekeni, Bernard Kumanda, has strong views on the subject. He thinks food is a priceless teaching aid. Since 1999, his pupils have received free school lunches. Donors such as the World Food Programme (WFP) provide the food: those sacks of grain (mostly mixes maize and soyabean flour, enriched with vitamin A) in that converted classroom. Local volunteers do the cooking – turning the dry ingredients into a bland but nutritious slop, and spooning it out on to plastic plates. The children line up in large crowds, cheerfully singing a song called "We are getting porridge".

D

When the school's feeding programme was introduced, enrolment as Msekeni doubled. Some of the pupils had switched from nearby schools that did not give out free porridge, but most were children whose families had previously kept them at home to work. These families were so poor that the long-term benefits of education seemed unattractive when set against the short-term gain of sending children out to gather firewood or help in the fields. One plate of porridge a day completely altered the calculation. A child fed at school will not howl so plaintively for food at home. Girls, who are more likely than boys to be kept out of school, are given extra snacks to take home.

E

When a school takes in a horde of extra students from the poorest homes, you would expect standards to drop. Anywhere in the world, poor kids tend to perform worse than their better-off classmates. When the influx of new pupils is not accompanied by any increase in the number of teachers, as was the case at Msekeni, you would expect standards to fall even further. But they have not. Pass rates at Msekeni improved dramatically, from 30% to 85%. Although this was an exceptional example, the nationwide results of school feeding programmes were still pretty good. On average, after a Malawian school started handing out free food it attracted 38% more girls and 24% more boys. The pass rate for boys stayed about the same, while for girls it improved by 9.5%.

F

Better nutrition makes for brighter children. Most immediately, well-fed children find it easier to concentrate. It is hard to focus the mind on long division when your stomach is screaming for food. Mr. Kumanda says that it used to be easy to spot the kids who were really undernourished. "They were the ones who stared into space and didn't respond when you asked them questions," he says. More crucially, though, more and better food helps brains grow and develop. Like any other organ

in the body, the brain needs nutrition and exercise. But if it is starved of the necessary calories, proteins and micronutrients, it is stunted, perhaps not as severely as a muscle would be, but stunted nonetheless. That is why feeding children at schools works so well. And the fact that the effect of feeding was more pronounced on girls than on boys gives a clue to who eats first in rural Malawian households. It isn't the girls.

G

On the global scale, the good news is that people are eating better than ever before. Homo sapiens has grown 50% bigger since the industrial revolution. Three centuries ago, chronic malnutrition was more or less universal. Now, it is extremely rare in rich countries. In developing countries, where most people live, plates and rice bowls are also fuller than ever before. The proportion of children under five in the developing world who are malnourished to the point of stunting fell from 39% in 1990 to 30% in 2000, says the World Health Organization (WHO). In other places, the battle against hunger is steadily being won. Better nutrition is making people cleverer and more energetic, which will help them grow more prosperous. And when they eventually join the ranks of the well-off, they can start fretting about growing too fat.

Questions 14-20

Reading Passage 2 has seven paragraphs, **A-G**.

Choose the correct heading for each paragraph from the list of heading below.

*Write the correct number, **i-xi**, in boxes **14-20** on your answer sheet.*

List of Headings

i Why better food helps students' learning
ii Becoming the headmaster of Msekeni
iii Surprising use of school premises
iv Global perspective
v Why students were undernourished
vi Surprising academic outcome
vii An innovative program to help girls
viii How food program is operated
ix How food program affects school attendance
x None of the usual reasons
xi How to maintain academic standard

14 Paragraph **A**
15 Paragraph **B**
16 Paragraph **C**
17 Paragraph **D**
18 Paragraph **E**

19 Paragraph **F**
20 Paragraph **G**

Questions 21-24

Complete the sentences below using **NO MORE THAN TWO WORDS / OR A NUMBER** from the passage.

*Write your answers in boxes **21-24** on your answer sheet.*

21 In Kumanda's school _____ are given to girls after the end of the school day.
22 Many children from poor families were sent to collect _____ from the field.
23 Thanks to the free food program, _____ of students passed the test.
24 The modern human is _____ bigger than before after the industrial revolution.

Questions 25-26

Choose **TWO** letters, **A-F**.

*Write the correct letters in boxes **25** and **26** on your answer sheet.*

Which **TWO** of the following statements are true?

A Some children are taught in the open air.
B Bernard Kumanda became the headmaster in 1991.
C No new staffs were recruited when attendance rose.
D Girls are often treated equally with boys in Malawi.
E Scientists have devised ways to detect the most underfed students in school.
F WHO is worried about malnutrition among kids in developing countries.

READING PASSAGE 3

You should spend about 20 minutes on **Questions 27-40** which are based on Reading Passage 3 below.

Shoemaker-Levy 9 Collision with Jupiter

A

The last half of July 1994 witnessed much interest among the astronomical community and the wider public in the collision of comet Shoemaker-Levy 9 with Jupiter. The comet was discovered on 25 March 1993 by Eugene and Carolyn Shoemaker and David Levy, using a 450 mm Schmidt camera at the Mount Palomar Observatory. The discovery was based on a photographic plate exposed two days earlier. The Shoemakers are particularly experienced comet hunters with 61 discoveries to their credit. Their technique relied on the proper motion of a comet to identify the object as a non-stellar body. They photograph large areas of the sky, typically with an eight minute exposure, and repeat the photograph 45 minutes later. Comparison of the two photographs with a stereo-microscope reveals any bodies which have moved against the background of fixed stars.

B

As so often in science, serendipity played a large part in the discovery of the Shoemaker-Levy 9. The weather in the night of 23 March was so poor that the observers would not normally have bothered putting film into their camera. However, they had a box of old film to hand which had been partially exposed by accident some days previously, so decided to insert it into the camera rather than waste good film. Fortunately, two of the film plates, despite being fogged round the edges captured the first image of a very strange, bar-shaped object. This object, which Carolyn Shoemaker first described as a squashed comet, later became known as comet Shoemaker-Levy 9.

C

Other, more powerful, telescopes revealed that the comet was in fact composed of 21 cemetery fragments, strung out in a line, which accounted for the unusual shape. The term string of pearls was soon coined. Some graphic proofs obtained by the Hubble Space Telescope shows the main fragments which at that time spanned a linear distance of approximately 600,000 km. Initially the fragments were surrounded by extensive dust clouds in the line of the nuclei but these later disappeared. Some of the nuclei also faded out, while others split into multiple fragments.

D

The size of the original comet and each of the fragments was, and still is, something of a mystery. The first analysis of the orbital dynamics of the fragments suggested that the comet was originally some 2.5 km in diameter with an average fragment diameter of 0.75 km. Later work gave corresponding diameters of approximately 10 km and 2 km and these values are now considered more likely. There was considerable variation in the diameters of different fragments.

E

Further calculations revealed that the cemetery fragments were on course to collide with Jupiter during July 1994, and that each fragment could deliver an energy equivalent to approximately 500,000 million tons of TNT. The prospect of celestial fireworks on such a grand scale immediately captured the attention of astronomers worldwide!

F

Each fragment was assigned an identity letter A-W and a coordinated program of observations was put in place worldwide to track their progress towards impact with Jupiter. As the cemetery fragments reached the cloud tops of Jupiter, they were travelling at approximately 30,000,000 km. The impacts occurred during 16-22 July. All took place at a latitude of approximately 48 degrees south which nominally placed them in the SSS Temperate Region, however visually they appeared close to the Jovian polar region. The impacts all occurred some 10-15 degrees round the limb in the far side of the planet as seen from Earth. However the rapid rotation of

the planet soon carried the impact sites into the view of Earth-based telescopes. The collisions lived up to all but the wildest expectations and provided a truly impressive spectacle.

G

Jupiter is composed of a relatively small core of iron and silicates surrounded by hydrogen. In the depths of the planet the hydrogen is so compressed that it is metallic in form; further from the center, the pressure is lower and the hydrogen is in its normal molecular form. The Jovian cloud tops visible from Earth consist primarily of methane and ammonia. There are other elements and compounds lurking in the cloud tops and below which are thought to be responsible for the colors seen in the atmosphere.

H

The smaller cemetery fragments plunged into Jupiter, rapidly disintegrated and left little trace; three of the smallest fragments, namely T, U and V left no discernible traces whatsoever. However, many of the cemetery fragments were sufficiently large to produce a spectacular display. Each large fragment punched through the cloud tops, heated the surrounding gases to some 20,000 K on the way, and caused a massive plume or fireball up to 2,000 km in diameter to rise above the cloud tops. Before encountering thicker layers of the atmosphere and disintegrating in a mammoth shock wave, the large fragments raised dark dust particles and ultra violet absorbing gases high into the Jovian cloud tops. The dark particles and ultra violet absorbing gases manifested themselves as a dark scar surrounding the impact site in visible light.

I

Somedays after collision the impact sites began to evolve and fade as they became subject to the dynamics of Jupiter's atmosphere. No one knows how long they will remain visible from Earth, but it is thought that the larger scars may persist for a year or more. The interest of professional astronomers in Jupiter is now waning and valuable work can therefore be performed by amateurs in tracking the evolution of the collision scars. The scars are easily visible in a modest telescope, and a large reflector will show them in some detail. There is scope for valuable observing work from now until Jupiter reaches conjunction with the Sun in November 2004.

J

Astronomers and archivists are now searching old records for possible previously unrecognized impacts on Jupiter. Several spots were reported from 1690 to 1872 by observers including William Herschel and Giovanni Cassini. The records of the BAA in 1927 and 1948 contain drawings of Jupiter with black dots or spots visible. It may be possible that comet impacts have been observed before, without their identity being realized, but no one can be sure.

Questions 27-31

Choose the most suitable headings for paragraphs **B-F** from the list of headings below

*Write appropriate numbers (**i-x**) in boxes **27-31** on your answer sheet.*

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

List of Headings

i Camera settings for observation
ii Collisions on stage
iii Size of comet
iv String of pearls
v Scientific explanations
vi Hubble Space Telescope
vii First discovery of the squashed comet
viii Power generated from the collisions
ix Calculations, expectations and predictions
x Change of the fragment's shape

27 Paragraph **B**
28 Paragraph **C**
29 Paragraph **D**
30 Paragraph **E**
31 Paragraph **F**

Questions 32 -35

Reading Passage 3 contains 10 paragraphs **A-J**.
Which paragraphs state the following information?
Write the appropriate letters **A-J** in boxes **32-35** on your answer sheet.

32 Shoemaker-Levy 9 comets had been accidentally detected.
33 The collision caused a spectacular vision on Jupiter.
34 Every single element of Shoemaker-Levy 9 was labeled.
35 Visual evidence explains the structure of Shoemaker-Levy 9.

Questions 36 -40

Complete the summary below.
Choose **NO MORE THAN THREE WORDS** from the passage for each answer.
The core of Jupiter, which is enclosed by hydrogen, consists of **36** _____ and **37** _____. Hydrogen is in metallic form as it is squeezed by pressure generated from the depths of the planet. The pressure is gradually reduced from the center to the outside layers, where hydrogen is in normal form of **38** _____. Far from the ground, methane and ammonia structures the **39** _____, which can

be observed from earth. Colors seen in the atmosphere is largely due to other particles **40** _____ in the cloud.