ACADEMIC READING

TIME ALLOWED: 1 hour   NUMBER OF QUESTIONS: 40

READING PASSAGE 1

You should spend about 20 minutes on ***Questions 1–12****, which are based on Reading Passage 1 on pages 173 and 174.*

The Birth of Blue

As a primary colour, blue has been the most difficult for artists and scientists to create.

Artists have always been enchanted by blue, yet fine blues have long been difficult to obtain. Blues are relatively rare in nature, and painters throughout the ages have therefore found themselves at the mercy of what contemporary chemical technology could offer. Some blues have been prohibitively expensive, others were unreliable. The quest for a good blue has driven some crucial technological innovations, showing that the interaction of art and science has not always been a one-way affair.

The first pigments were simply ground-up coloured minerals dug from the earth. But few blue minerals are suitable as pigments – so there are no blues in cave art. Ancient Egyptian artists used blue prominently, however, because they knew how to make a fine artificial pigment, now known as Egyptian blue.

The discovery of Egyptian blue, like that of many other artificial pigments, was almost certainly an accident. The Egyptians manufactured blue-glazed stones and ornaments called *faience* using a technique they inherited from the Mesopotamians. Faience manufacture was big business in the ancient world – it was traded all over Europe by 1500 BC. Faience is made by heating stone ornaments in a kiln with copper minerals such as malachite. Egyptian blue, which was made from at least 2500 BC, comes from firing chalk or limestone with sand and copper minerals, and probably appeared by the chance mixture of these ingredients in a faience kiln.

Scientists recently deduced the secrets of another ancient blue: Maya blue, used for centuries throughout central America before the Spanish Conquest. This is a kind of clay – a mineral made of sheets of atoms – with molecules of the blue dye indigo wedged between the sheets. Using indigo in this way makes it less liable to decompose. No one has made colours this way since the Mayas, and no one knows exactly how they did it. But technologists are now interested in using the same trick to make stable pigments from other dyes.

The finest pigment available to medieval artists was ultramarine, which began to appear in Western art in the 13th century. It was made from the blue mineral *lapis lazuli*, of which only one source was known: the remote mines of Badakshan, now in Afghanistan. In addition to the difficulty of transporting the mineral over such distances, making the pigment was a tremendously laborious business. Lapis lazuli turns greyish when powdered because of impurities in the mineral. To extract the pure blue pigment, the powder has to be mixed to a dough with wax and kneaded repeatedly in water.

As a result, ultramarine could cost more than its weight in gold, and medieval artists were very selective in using it. Painters since the

Renaissance craved a cheaper, more accessible, blue to compare with ultramarine. Things improved in 1704, when a Berlin-based colour maker called Diesbach discovered the first "modern" synthetic pigment: Prussian blue. Diesbach was trying to make a red pigment, using a recipe that involved the alkali potash. But Diesbach's potash was contaminated with animal oil, and the synthesis did not work out as planned. Instead of red, Diesbach made blue.

The oil had reacted to produce cyanide, a vital ingredient of Prussian blue. Diesbach kept his recipe secret for many years, but it was discovered and published in 1724, after which anyone could make the colour. By the 1750s, it cost just a tenth of ultramarine. But it wasn't such a glorious blue, and painters still weren't satisfied. They got a better alternative in 1802, when the French chemist Louis Jacques Thenard invented cobalt blue.

Best of all was the discovery in 1826 of a method for making ultramarine itself. The French Society for the Encouragement of National Industry offered a prize of 6,000 francs in 1824 to anyone who could make artificial ultramarine at an affordable price. The Toulouse chemist Jean-Baptiste Guimet was awarded the prize two years later, when he showed that ultramarine could be made by heating china clay, soda, charcoal, sand and sulphur in a furnace. This meant that there was no longer any need to rely on the scarce natural source, and ultramarine eventually became a relatively cheap commercial pigment (called French ultramarine, as it was first mass-produced in Paris).

In the 1950s, synthetic ultramarine became the source of what is claimed to be the world's most beautiful blue. Invented by the French artist Yves Klein in collaboration with a Parisian paint manufacturer, Edouard Adam, International Klein Blue is a triumph of modern chemistry. Klein was troubled by how pigments lost their richness when they were mixed with liquid binder to make a paint. With Adam's help, he found that a synthetic resin, thinned with organic solvents, would retain this vibrant texture in the dry paint layer. In 1957, Klein launched his new blue with a series of monochrome paintings, and in 1960 he protected his invention with a patent.

Questions 1–4

Complete the summary below. Choose **NO MORE THAN THREE WORDS** *from the passage for each answer.*

The colours used in cave paintings and other early art were made by crushing .....**1**..... . However, later artists have generally had to rely on the .....**2**..... of the day for their supplies of blue. Among the first examples of the widespread use of blue was in .....**3**..... art. Over the centuries, many more attempts to create acceptable blues have been made, some of which have led to significant .....**4**..... .

1 .... **2** .... **3** .... **4** ....

Questions 5 and 6

Choose the appropriate letter ***A–D***.

5 What was the main disadvantage in using ultramarine for medieval artists?

A It contained a number of impurities.
B It was excessively expensive.
C The colour wasn't permanent.
D The preparation process was hazardous.

6 The discovery of Prussian blue was the result of

A using the wrong quantity of an ingredient.
B mixing the wrong ingredients together.
C including an ingredient that was impure.
D using an ingredient of the wrong colour.

Questions 7–12

Look at the following notes that have been made about the types of blue described in Reading Passage 1. Match each description with a type of blue.

Example	*Answer*
was developed in the early years of the 19th century	**E**

NOTES

7 derived from a scarce natural resource ....

8 specially designed to retain its depth of colour when used in paint ....

9 was cheap to produce but had limited appeal for artists ....

10 made using a technique which is not yet fully understood ....

11 thought to have been produced during another manufacturing process ....

12 came to be manufactured inexpensively in large quantities ....

Types of Blue

A Egyptian blue
B Maya blue
C ultramarine
D Prussian blue
E cobalt blue
F French ultramarine
G International Klein Blue

READING PASSAGE 2

*You should spend about 20 minutes on **Questions 13–25**, which are based on Reading Passage 2 on pages 177 and 178.*

Questions 13–17

*Complete each of the following statements with the best ending **A–I** from the box below.*

13 Napier grass ....

14 The plant called *Striga* ....

15 Growing single crops ....

16 Ploughing the land ....

17 Sowing black oats ....

List of Endings

A reduces losses due to plant diseases.
B can lead to soil erosion.
C causes major financial losses.
D increases soil fertility.
E discourages the growth of weeds.
F helps to retain carbon dioxide.
G destroys harmful insect larvae.
H helps prevent global warming.
I encourages pests to breed.

Questions 18–25

Complete the table below.

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

Area	**Strategy**	**Benefits to farmers**
East Africa	**18** .... with food crop.	Lower costs Higher yields
19	Growing mixed crops together.	Higher yields
Madagascar	Transplanting seedlings earlier. Leaving paddy fields unflooded. Replacing chemical fertilisers with **20**	Higher yields
Cuba	Reducing **21** .... Using **22** .... instead of farm vehicles. Growing mixed crops together.	Yields doubled Citizens' **23** .... increased.
Latin America	Zero-tillage	Lower costs Improved **24** .... Higher yields Higher **25** ....

An ordinary miracle

Bigger harvests, without pesticides or genetically modified crops? Farmers can make it happen by letting weeds do the work.

Across East Africa, thousands of farmers are planting weeds in their maize fields. Bizarre as it sounds, their technique is actually raising yields by giving the insect pests something else to chew on besides maize. "It's better than pesticides, and a lot cheaper," said Ziadin Khan, whose idea it is, as he showed me round his demonstration plots at the Mbita Point research station on the shores of Lake Victoria in Kenya. "And it has raised farm yields round here by 60 to 70 per cent."

His novel way of fighting pests is one of a host of low-tech innovations boosting production by 100 per cent or more on millions of poor Third World farms in the past decade. This "sustainable agriculture" just happens to be the biggest movement in Third World farming today, dwarfing the tentative forays into genetic manipulation.

In East Africa, maize fields face two major pests, and Khan has a solution to both. The first is an insect called the *stem borer*, whose larvae eat their way through a third of the region's maize most years. But Khan discovered that the borer is even fonder of a local weed, napier grass. By planting napier grass in their fields, farmers can lure the stem borer away from the maize – and into a honey-trap. For the grass produces a sticky substance that traps and kills stem borer larvae. The second pest is *Striga*, a parasitic plant that wrecks $10 billion worth of maize crops every year, threatening the livelihoods of 100 million Africans. "Weeding *Striga* is one of the most time-consuming activities for millions of African women farmers," says Khan. But he has an antidote: another weed called *Desmodium*. "It seems to release another sort of chemical that *Striga* doesn't like. At any rate, where farmers plant *Desmodium* between rows of maize, *Striga* won't grow."

"The success of sustainable agriculture is dispelling the myth that modern techno-farming is the most productive method," says Miguel Altieri of the University of California, Berkeley. "In Mexico, it takes 1.73 hectares of land planted with maize to produce as much food as one hectare planted with a mixture of maize, squash and beans. The difference," he says, "comes from the reduction of losses due to weeds, insects and diseases and a more efficient use of the available resources of water, light and nutrients. Monocultures breed pests and waste resources," he says.

Researchers from the Association Tefy Saina, a Madagascan group working for local farmers, were looking for ways to boost rice yields on small farms. They decided to make the best use of existing strains rather than track down a new breed of super-rice. Through trial and error, a new system was developed that raises typical rice yields from three to twelve tonnes per hectare. The trick is to transplant seedlings earlier and in smaller numbers so that more survive; to keep paddies unflooded for much of the growing period; and to help the plants grow using compost rather than chemical fertilisers. The idea has grown like wildfire, and 20,000 have adopted the idea in Madagascar alone.

Few countries have switched wholesale to sustainable agriculture. But Cuba has. The collapse of the Soviet Union in 1990 cut off cheap supplies of grain, tractors and agrochemicals. Pesticide use halved overnight, as did the calorie intake of its citizens. The cash-strapped country was forced to embrace low-input farming or starve. "Today," says Fernando Funes of the Country's Pasture and Fodder Research Institute, "teams of oxen replace the tractors, and farmers have adopted organic methods, mixing maize with beans and cassava and doubling yields in the process, helping average calorie intake per person rise back to pre-1990 levels."

Worldwide, one of the most widely adopted sustainable techniques has been to throw away the plough, the ultimate symbol of the farmer. Ploughing aerates the soil, helping rot weeds and crop residues. But it can also damage soil fertility and increase erosion. Now millions of Latin American farmers have decided it isn't worth the effort. A third of Argentina's farms no longer use the plough. Instead, they fight weeds by planting winter crops, such as black oats, or by spraying a biodegradable herbicide such as glyphosate. "The farmers saw results in a short time – reduced costs, richer soils, bigger grain yields and increased income," says Lauro Bassi of EPAGRI, the agricultural research institute in Santa Catarina state, southern Brazil, which has been promoting the idea.

Zero-tillage also benefits the planet in general. Unploughed soils hang on to carbon that would otherwise escape into the air as carbon dioxide when organic matter rots. "A one-hectare field left unploughed can absorb up to a tonne of carbon every year," says Pretty, "making soils a vital element in preventing global warming."

Sustainable agriculture is no magic bullet for feeding the world. It is an approach rather than a blueprint. Small farms with low yields stand to gain the most and agribusiness the least. But it does offer an alternative for the millions of small farms that have plenty of hands to work the land, but not the skills or financial resources to adopt conventional mechanised farming.

READING PASSAGE 3

*You should spend about 20 minutes on **Questions 26–40**, which are based on Reading Passage 3 on pages 179 and 180.*

Questions 26–30

Complete the sentences below with words taken from Reading Passage 3.

*Use **NO MORE THAN THREE WORDS** for each answer.*

Scientists base their predictions about global warming on evidence from

26 ....

Two weather conditions which are likely to become more common as an indirect result of global warming are **27** .... and ....

Once infectious disease has become established in an area, its **28** .... can prove extremely difficult.

Mosquitoes can be effectively destroyed by **29** .... and

30 ....

Is Global Warming Harmful to Health?

Today, few scientists doubt the atmosphere is warming. Most also agree that the rate of heating is accelerating and that the consequences of this temperature change could become increasingly disruptive. Even high-school students can recite some projected outcomes: the oceans will warm, and glaciers will melt, causing sea levels to rise and salt water to inundate low-lying coasts. Yet less familiar effects could be equally detrimental. Notably, computer models indicate that global warming, and other climate alterations it induces, will expand the incidence and distribution of many serious medical disorders.

Heating of the atmosphere can influence health through several routes. Most directly, it can generate more, stronger and hotter heatwaves, which will become especially treacherous if the evenings fail to bring cooling relief. Global warming can also threaten human well-being profoundly, if somewhat less directly, by revising weather patterns – particularly by increasing the frequency and intensity of floods and droughts and by causing rapid swings in the weather. Aside from causing death by drowning or starvation, these disasters promote by various means the emergence, resurgence and spread of infectious disease. That prospect is deeply troubling, because infectious illness may kill fewer people in one fell swoop than a raging flood or an extended drought, but once it takes root in a community, it often defies eradication and can invade other areas.

Mosquitoes Rule in the Heat

Diseases relayed by mosquitoes – such as malaria, dengue fever, yellow fever and several kinds of encephalitis – are among those eliciting the greatest concern as the world warms. Mosquito-borne disorders are projected to become increasingly prevalent because their insect carriers, or "vectors", are very sensitive to meteorological conditions. Cold can be a friend to humans, because it limits mosquitoes to seasons and regions where temperatures stay above certain minimums. Winter freezing kills many eggs, larvae and adults outright.

Excessive heat kills insects as effectively as cold does. Nevertheless, within their survivable range of temperatures, mosquitoes proliferate faster and bite more as the air becomes warmer. At the same time, greater heat speeds the rate at which the pathogens inside them reproduce and mature. As whole areas heat up, then, mosquitoes could expand into formerly forbidden territories, bringing illness with them. Further, warmer nighttime and winter temperatures may enable them to cause more disease for longer periods in the areas they already inhabit.

The extra heat is not alone in encouraging a rise in mosquito-borne infection. Intensifying floods and droughts resulting from global warming can each trigger outbreaks by creating breeding grounds for insects whose desiccated eggs remain viable and hatch in still water. As floods recede, they leave puddles. In times of drought, streams can become stagnant pools, and people may put out containers to catch water; these pools and pots, too, can become incubators for new mosquitoes. And the insects can gain another boost if climate change or other processes (such as alterations of habitats by humans) reduce the populations of predators that normally keep mosquitoes in check.

Opportunists like Sequential Extremes

The increased climate variability accompanying warming will probably be more important than the rising heat itself in fuelling unwelcome outbreaks of certain vector-borne illnesses. For instance, warm winters followed by hot, dry summers (a pattern that could become all too familiar as the atmosphere heats up) favor the transmission of St Louis encephalitis and other infections that cycle among birds, urban mosquitoes and humans.

This sequence seems to have abetted the surprise emergence of the West Nile virus in New York City in 2000. No one knows how this virus found its way into the US. But one reasonable explanation for its persistence and amplification here centers on the weather's effects on *Culex pipiens* mosquitoes, which accounted for the bulk of transmission. These urban dwellers typically lay their eggs in damp basements, gutters, sewers and polluted pools of water.

The interaction between the weather, the mosquitoes and the virus probably went something like this: the mild winter of 1998–99 enabled many of the mosquitoes to survive into the spring, which arrived early. Drought in spring and summer concentrated nourishing organic matter in their breeding areas and simultaneously killed off mosquito predators, such as lacewings and ladybugs, that would otherwise have helped limit mosquito populations. Drought would also have led birds to congregate more, as they shared fewer and smaller watering holes, many of which were shared, naturally, by mosquitoes.

Once mosquitoes acquired the virus, the July heatwave that accompanied the drought would speed up the viral maturation inside the insects. Consequently, as infected mosquitoes sought blood meals, they could spread the virus to birds at a rapid rate. As bird after bird became infected, so did more mosquitoes, which ultimately fanned out to infect human beings. Torrential rains towards the end of August provided new puddles for the breeding of *C. pipiens* and other mosquitoes, unleashing an added crop of potential virus carriers.

Solutions

The health toll taken by global warming will depend to a large extent on the steps taken to prepare for the dangers. The ideal defensive strategy would have multiple components, including improved surveillance systems to spot the emergence or resurgence of infectious diseases; predicting when environmental conditions could become conducive to disease outbreaks; and limiting human activities that contribute to the heating or that exacerbate its effects.

Questions 31–35

Do the following statements agree with information given in Reading Passage 3?

Write:

TRUE	*if the statement is true according to the passage*
FALSE	*if the statement is false according to the passage*
DOES NOT SAY	*if there is no information about this in the passage*

31 Mosquito eggs are capable of surviving dry conditions.

32 Animals which feed on mosquitoes may be adversely affected by global warming.

33 Mosquitoes are becoming increasingly resistant to standard drugs.

34 Higher temperatures are likely to be the most important factor in encouraging diseases carried by mosquitoes.

35 The mosquitoes which transmit West Nile disease breed in rural areas.

Questions 36–40

Complete the flow chart with words taken from Reading Passage 3.

Use ***NO MORE THAN THREE WORDS*** *for each answer.*

Weather and West Nile Virus

MILD WINTER

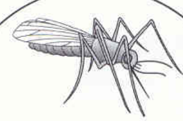
More mosquitoes than usual survived.

DRY SPRING AND SUMMER

Mosquitoes nourished by **36** .... in breeding sites.

Lack of rain killed **37** ....

More **38** .... gathered at remaining water sources.



MOSQUITO POPULATION GREW LARGE

39 ....

Virus spreads rapidly, eventually infecting humans.

HEAVY AUGUST RAINS

Newly created **40** .... enabled insect population to increase.