ACADEMIC READING 60 minutes

READING PASSAGE 1

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

Ocean Acidification

Caspar Henderson reports on some new concerns.

A few years ago, biologist, Victoria Fabry, saw the future of the world's oceans in a jar. She was aboard a research ship in the North Pacific, carrying out experiments on a species of pteropod – small molluscs with shells up to a centimetre long, which swim in a way that resembles butterfly flight, propelled by small flaps. Something strange was happening in Fabry's jars. 'The pteropods were still swimming, but their shells were visibly dissolving,' says Fabry. She realised that the animals' respiration had increased the carbon dioxide (CO_2) in the jars, which had been sealed for 48 hours, changing the water's chemistry to a point where the calcium carbonate in the pteropods' shells had started to dissolve. What Fabry had stumbled on was a hint of 'the other CO_2 problem'.

It has taken several decades for climate change to be recognised as a serious threat. But another result of our fossil-fuel habit – ocean acidification – has only begun to be researched in the last few years. Its impact could be momentous, says Joanie Kleypas of the National Centre for Atmospheric Research in Boulder, Colorado.

CO_2 forms carbonic acid when it dissolves in water, and the oceans are soaking up more and more of it. Recent studies show that the seas have absorbed about a third of all the fossil-fuel carbon released into the atmosphere since the beginning of the industrial revolution in the mid-eighteenth century, and they will soak up much more over the next century. Yet until quite recently many people dismissed the idea that humanity could alter the acidity of the oceans, which cover 71% of the planet's surface to an average depth of about four kilometres. The ocean's natural buffering capacity was assumed to be capable of preventing any changes in acidity even with a massive increase in CO_2 levels.

And it is – but only if the increase happens slowly, over hundreds of thousands of years. Over this timescale, the release of carbonates from rocks on land and from ocean sediments can neutralise the dissolved CO_2, just like dropping chalk in an acid. Levels of CO_2 are now rising so fast that they are overwhelming the oceans' buffering capacity.

In 2003 Ken Caldeira of the Carnegie Institution in Stanford, and Michael Wickett at the Lawrence Livermore National Laboratory, calculated that the absorption of fossil CO_2 could make the oceans more acidic over the next few centuries than they have been for 300 million years, with the possible exception of rare catastrophic events. The potential seriousness of the effect was underlined in 2005 by the work of James Zachos of the University of California and his colleagues, who studied one of those rare catastrophic events. They showed that the mass extinction of huge numbers of deep-sea creatures around 55 million years ago was caused by ocean acidification after the release of around 4500 gigatonnes of carbon. It took over 100,000 years for the oceans to return to their normal state.

Around the same time as the Zachos paper, the UK's Royal Society published the first comprehensive report on ocean acidification. It makes grim reading, concluding that ocean acidification is inevitable without drastic cuts in emissions. Marine ecosystems, especially coral reefs, are likely to be affected, with fishing and tourism based around reefs losing billions of dollars each year. Yet the report also stressed that there is huge uncertainty about the effects on marine life.

The sea creatures most likely to be affected are those that make their shells or skeletons from calcium carbonate, including tiny plankton and huge corals. Their shells and skeletons do not dissolve only because the upper layers of the oceans are supersaturated with calcium carbonate. Acidification reduces carbonate ion concentrations, making it harder for organisms to build their shells or skeletons. When the water drops below the saturation point, these structures will start to dissolve. Calcium carbonate comes in two different forms, aragonite and calcite, aragonite being more soluble. So organisms with aragonite structures, such as corals, will be hardest hit.

So far the picture looks relentlessly gloomy, but could there actually be some positive results from adding so much CO_2 to the seas? One intriguing finding, says Ulf Riebesell of the Leibniz Institute of Marine Sciences in Kiel, Germany, concerns gases that influence climate. A few experiments suggest that in more acidic conditions, microbes will produce more volatile organic compounds such as dimethyl sulphide, some of which escapes to the atmosphere and causes clouds to develop. More clouds would mean cooler conditions, which could potentially slow global warming.

Calculating the effect of ocean acidification on people and economies is virtually impossible, but it could be enormous. Take the impact on tropical corals, assuming that warming and other pressures such as pollution do not decimate them first. Reefs protect the shorelines of many countries. Acidification could start eating away at reefs just when they are needed more than ever because of rising sea levels.

'No serious scientist believes the oceans will be devoid of life,' says Caldeira. 'Wherever there is light and nutrients something will live. A likely outcome will be a radical simplification of the ecosystem.' Taking this and other scientists' views into account, it seems clear that acidification will mean the loss of many species, so our children will not see the amazingly beautiful things that we can. It is important to tell them to go and see the corals now before it is too late.

Questions 1 – 7

Answer the questions below.

Choose ***NO MORE THAN THREE WORDS AND/OR A NUMBER*** *from the passage for each answer.*

Write your answers in boxes 1 – 7 on your answer sheet.

1 What does the pteropod use to move itself through the water?

2 Which part of the pteropods was being damaged by increased acidification?

3 What proportion of the carbon released over the last 200 years has been taken in by the oceans?

4 Where do carbonates enter the oceans from?

5 How long did the oceans need to recover after the destruction of marine life by acidification 55 million years ago?

6 Which businesses will suffer if reefs are damaged?

7 What type of creatures make their skeletons out of aragonite?

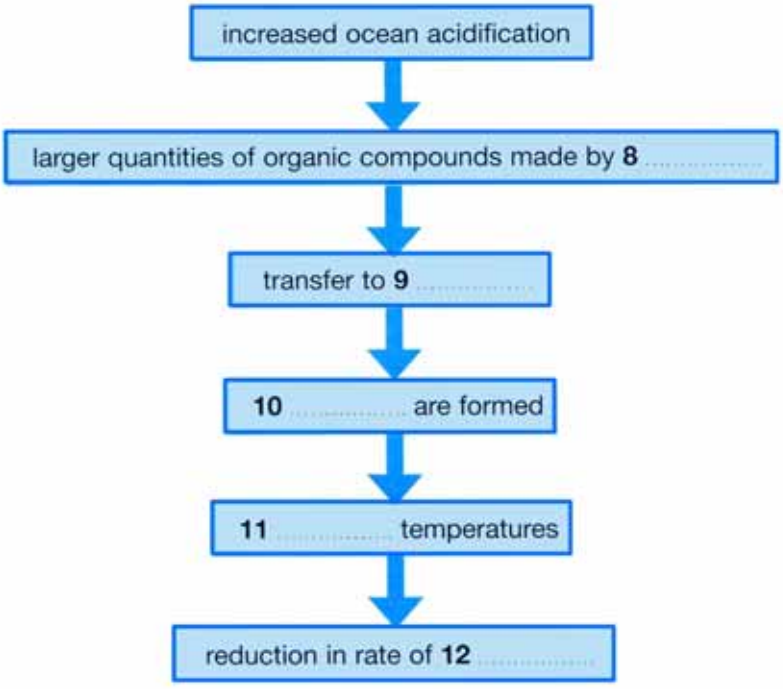
Questions 8 – 12

Complete the flow-chart below.

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

Write your answers in boxes 8 – 12 on your answer sheet.

A Possible Benefit from Increased CO_2 Levels in the Sea



Question 13

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

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

13 Which of the following best summarises the writer's view in the passage?

A We will have to wait and see if acidification has serious effects.

B It is clear that acidification will cause huge damage to marine life.

C It is likely that increased CO_2 will change marine ecosystems considerably.

D The theory that increased CO_2 could have positive results is believable.

READING PASSAGE 2

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

A New Fair Trade Organisation

Trade has, so far, proved ineffective in solving the major problems faced by most nations. However, the answer to the injustices of the existing trade regime is not no trade, but fair trade.

The existing regime forbids poor nations from following the path taken by the rich. With the exceptions of Switzerland, Belgium and the Netherlands, all the nations that have become independently wealthy did so with the help of a mechanism economists call 'infant industry protection': defending new sectors from foreign competition until they are big enough to compete on equal terms. The textile industry in Britain, for example, on which the Industrial Revolution was built in the nineteenth century, was nurtured and promoted by means of tariffs (or trade taxes) and the outright prohibition of competing goods. Between 1864 and 1913, the US was the most heavily protected nation on earth. Only when these countries had established technological and commercial superiority did they suddenly discover the virtues of unimpeded competition.

For nations to develop in direct competition with countries with established industries is like learning to swim in a fast-flowing river: you are likely to be swept away and drowned long before you acquire the necessary expertise. Your competitors have experience, legal rights and established marketing networks on their side; your infant industries have none of these. It is all but impossible, in other words, for poor nations to extract money from the rich unless they can safeguard some key parts of their economies.

Clearly, nations that are currently poor should be permitted to defend certain industries from foreign competition with the help of tariff barriers and subsidies. Rich nations, on the other hand, should be permitted neither to subsidise their industries nor to impose tariffs on imports. Nations should be forced gradually to lift their protections as they develop. So, the first function of what we might call the Fair Trade Organisation (FTO) would be to lay down the rules governing the protections and privileges permitted at different stages of development.

A fair-trade system should, or so we should hope, slowly push the world towards genuine free trade, which is likely to be the most equitable means of governing nations' relationships with each other. This system could provide a potent means by which the world could begin to move towards the economic equality that is an essential precondition for political equality. It would not, however, directly address some of the other critical problems that the people of poor nations confront – such as inadequate working conditions, environmental devastation and the inordinate power of the multinational corporations.

Many campaigners in the rich world have suggested that the best way to raise standards is to discriminate, through tariffs or other measures, against imports from countries where workers or the environment are mistreated. This approach has also been advocated by trades unions seeking to protect members' jobs from foreigners. Unsurprisingly, it is deeply resented by the very people it is supposed to help: the workers of the poor world.

If our purpose is to regulate international trade, then it surely makes sense to address the behaviour, not of nation states, but of the multinational corporations operating between them. So a second function of the FTO could be to set the standards to which those corporations must conform. A corporation would not be permitted to trade between nations unless it could demonstrate that, at every stage of manufacture and distribution, its own operations and those of its suppliers met the necessary standards.

If, for example, a food-processing corporation based in Europe wished to import cocoa from an African country, it would need to demonstrate that the plantation owners it bought from were not using banned pesticides, expanding into protected forests or failing to conform to whatever other standards the FTO set. The company's performance would be assessed, at its own expense, by monitors accredited to the organisation.

One other precondition of justice is that producers and consumers should carry their own costs, rather than dumping them on other people. The monitors deployed by the FTO could determine whether or not companies are paying a fair price for the resources they use. Companies would, among other costs, have to buy enough of a nation's carbon quota to cover the fossil fuel they consume.

One of the many beneficial impacts of such full-cost accounting would be that everything that could be processed in the country of origin would be. No multinational company would export logs, coffee beans or cotton, as it requires far more (costly) energy to transport these bulky resources from one place to another than would be involved in exporting the finished products – furniture, instant coffee and T-shirts (all currently manufactured on the other side of the world). Those nations which are currently locked into the export of raw materials would become the most favoured locations for manufacturing.

Under this scheme, export growth comes to measure something quite different. At present it represents a mixture of gains and losses, which are misleadingly compounded into a single figure. The loss of natural resources is 'added' to the genuine addition of value provided by the application of labour. The FTO system would effectively separate these measures. The extraction and export of natural resources would in most cases be accounted as a loss. The application of human labour would be measured as a gain. Nations would be able to see immediately whether they were being enriched or impoverished through trade. To introduce these measures in the face of the resistance of the world's most powerful governments and companies would require severe and unusual methods. But the goal of universal fair trade would permit the global economic levelling without which there can be no justice.

Questions 14 – 19

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

Write the correct letter in boxes 14 – 19 on your answer sheet.

14 The writer refers to textile production in Britain in order to

A point out how differently industries were financed in the past.

B show how unnecessary tariff barriers are for countries today.

C help the reader understand how infant industry protection works.

D compare European trade development with that of the United States.

15 What is the writer's main point in the third paragraph?

A Businesses will succeed if they learn from established companies.

B Detailed market research is often neglected in developing countries.

C You have to be prepared to adapt your products quickly to follow fashion.

D New industries in poor countries will probably fail without protection.

16 According to the writer, a fair trade system could have the effect of

A improving safety in the majority of workplaces around the world.

B preventing the continued destruction of endangered wildlife habitats.

C encouraging states to work together in a more even-handed way.

D making politicians agree to more representative systems of government.

17 What point is the writer making in the sixth paragraph?

A The trades unions' aim is to help foreign workers gain better conditions.

B The trades unions are concerned about the effects of imports on local jobs.

C Workers in poor countries are grateful for the trades unions' support.

D Campaigners are right to suggest imposing tariffs against bad treatment.

18 According to the writer, what is one of the benefits of full-cost accounting?

A Factories would be set up and jobs created in the country of origin.

B Multinational companies would consume fewer natural resources.

C The export of finished products around the world would decrease.

D Countries would be able to keep their resources for the domestic market.

19 What conclusion does the writer come to about the FTO system?

A It would help to combat injustice in its many different forms.

B It would be difficult to introduce but would be worth the effort.

C States all over the world would earn more through trade as a result of it.

D Multinationals would accept it because it measures exports more precisely.

Questions 20 – 26

Complete the summary below.

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

Write your answers in boxes 20 – 26 on your answer sheet.

A Proposal for Regulating Multinational Corporations

The FTO would determine the **20** ..... for the multinational corporations to follow. In this way, a multinational corporation would have to prove that all aspects of the way it produced its goods and the systems for their **21** ..... to customers was in line with FTO requirements. Similarly it would need to satisfy the FTO that the processes employed by any **22** ..... that it used were also acceptable.

As an illustration, in order to source cocoa from Africa, a corporation would have to ensure that no illegal **23** ..... were being used by the **24** ..... during cultivation and that they had not taken over land from **25** .....

It would not be sufficient for multinational corporations to say that these points had been checked. Their conduct would have to be inspected by **26** ..... appointed by the FTO.

READING PASSAGE 3

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

The First Antigravity Machine?

It was one of the biggest science stories of the 1990s. Even now, the facts behind it remain hotly disputed. And small wonder, for if the claims made for the small disc, the focus of the controversy, are true, it may be possible to break through one of the great barriers in the scientific world and control the most potent of cosmic forces: gravity. Huge innovations in flight and space travel could arise from that.

The first gravity-blocking system to be taken seriously by scientists appeared in a laboratory in Tampere University of Technology, Finland. A Russian scientist named Dr Evgeny Podkletnov created a disc 275mm across, made from a substance which combined copper, barium and the 'rare Earth metal' called yttrium, which is known to be a high-temperature superconductor (a substance that conducts electricity without resistance). When chilled with liquid nitrogen at -196° C (a high temperature compared with other superconductors), this material loses all its electrical resistance, and can levitate (lift) in a magnetic field. That may seem amazing for a ceramic-like material – and it won a Nobel Prize for the scientists, Karl Müller and Johannes Bednorz, who first demonstrated it in the 1980s. But according to Podkletnov, the disc had another far more astounding property.

In 1992, while experimenting with rotating superconductors, Podkletnov noticed that pipe-smoke from a nearby researcher was drifting into a vertical column above the spinning disc. Intrigued by this phenomenon, he decided to devise an experiment to investigate further. A superconductive disc, surrounded by liquid nitrogen was magnetically levitated and rotated at high speed – up to 5,000 revolutions per minute (rpm) in a magnetic field. An object was suspended from a sensitive balance above the disc. It was enclosed in a glass tube to shield it from any effects of air currents. During the course of a series of tests, Podkletnov was able to observe that the object lost a variable amount of weight from less than 0.5 percent to 2 percent of its total weight. This effect was noted with a range of materials from ceramics to wood. The effect was slight, yet the implications were revolutionary: the disc appeared to be partly shielding the object from the gravitational pull of the Earth.

This was just the start, claimed Podkletnov. While far short of the 100 percent reduction in weight needed to send astronauts into space, for example, it was infinitely greater than the amount predicted by the best theory of gravity currently in existence: Einstein's theory of general relativity (GR), published in 1905. According to Einstein, gravity is not some kind of 'force field', like magnetism, which can – in principle at least – be screened out. Instead, GR views gravity as a distortion in the very fabric of space and time, that permeates the whole cosmos. As such, any claim to have shielded objects from gravity is to defy Einstein himself.

Podkletnov's claims were subjected to intense scrutiny when he submitted them for publication. The UK Institute of Physics had Podkletnov's paper checked by three independent referees, but none could find a fatal flaw. His research was set to appear in the respected *Journal of Physics D* when events took an unexpected turn. The claims were leaked to the media, sparking world-wide coverage of his apparent breakthrough. Then Podkletnov suddenly withdrew the paper from publication and refused to talk to the press.

Rumours began to circulate of unknown backers demanding silence until the device had been fully patented. But for many scientists the strange events were all too familiar. Podkletnov was just the latest in a long line of people to have made claims about defying gravity. Most of these have come from madcap inventors, with bizarre devices – often with some kind of spinning disc. But occasionally, respectable academics have made such claims as well.

One instance of this occurred in the late 1980s when scientists at Tohoku University, Japan, made headlines with research suggesting that apparatus, known as a gyroscope, lost 0.01 percent of its weight when spinning at up to 13,000 rpm. Oddly the effect only appeared if the gyroscope was spinning anticlockwise – raising suspicions that some mechanical peculiarity was to blame. Attempts by scientists at the University of Colorado to replicate the effect failed.

Then Professor Giovanni Modanese, an Italian theoretical physicist, became interested. He had read an earlier paper by Podkletnov, hinting at a connection between superconductivity and gravity shielding. Modanese wondered if the magnetic fields surrounding the superconductive disc might somehow assimilate part of the gravitational field under it. He published some calculations based on his idea in 1995 – and soon discovered that taking 'antigravity' seriously was a career-limiting move.

The revelations about Podkletnov's antigravity research led to reports of major corporations setting up their own studies. In 2000, the UK defence contractor BAE Systems was said to have launched 'Project Greenglow' to investigate Podkletnov's gravity shield effect. Then it emerged that the US aircraft builder Boeing was also investigating, suggesting it too had an interest in the effect. Groups in other countries were also rumoured to be carrying out studies. Yet not one of the teams has reported confirmation of the original findings. Some projects have been wound up without producing results either way. So for the time being, it seems that the dream of controlling gravity will remain precisely that.

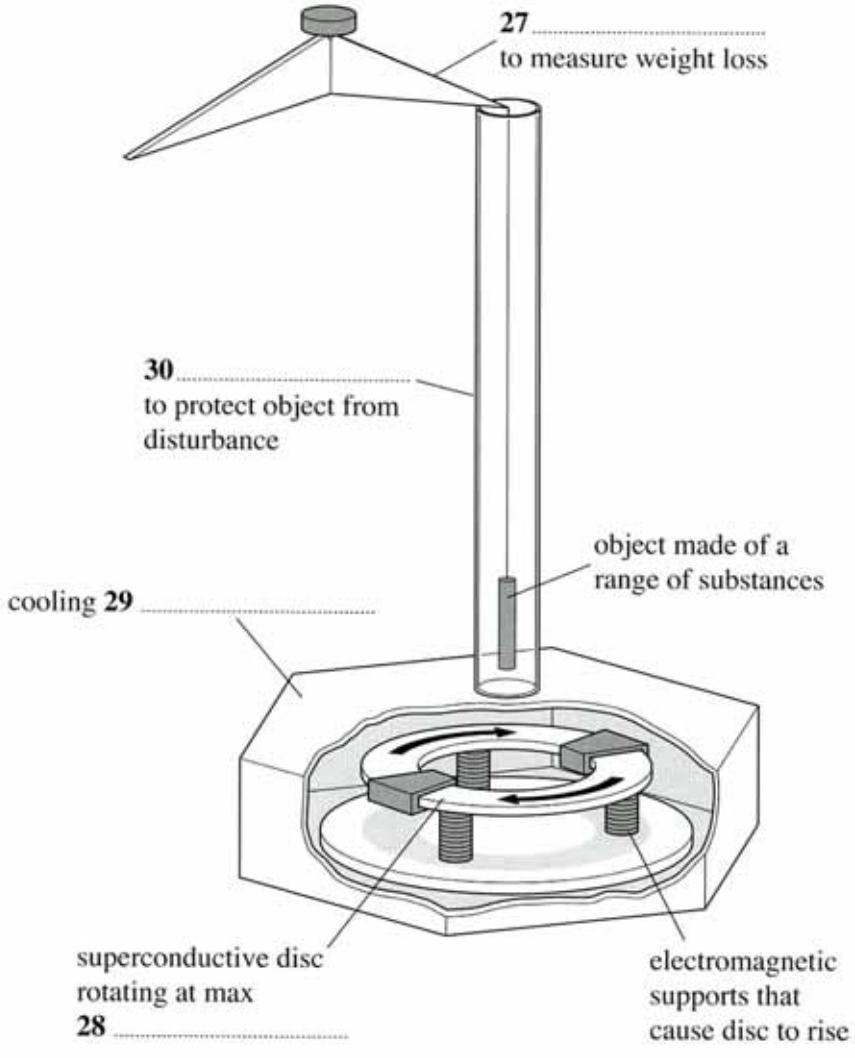
Questions 27 – 30

Label the diagram below.

Choose ***NO MORE THAN THREE WORDS AND/OR A NUMBER*** *from the passage for each answer.*

Write your answers in boxes 27 – 30 on your answer sheet.

Podkletnov's Antigravity Device



Questions 31 – 35

Classify the following findings as belonging to

A *Podkletnov*
B *Tohoku University*
C *Modanese*

Write the correct letter, ***A, B*** *or* ***C*** *in boxes 31 – 35 on your answer sheet.*

31 The experiment only works if the equipment moves in a particular direction.

32 Varying amounts of weight are lost as a result of the test.

33 Gravity could be absorbed by a magnetic field.

34 Superconductive material seems to screen an object from gravity.

35 Weight loss occurs when the equipment rotates at speeds reaching 13,000 rpm.

Questions 36 – 40

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

In boxes 36 – 40 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.*

36 Podkletnov won a prize for his initial work on superconductive substances.

37 A chance observation led Podkletnov to experiment with gravity blocking.

38 Einstein challenged earlier experiments on antigravity.

39 Modanese suffered professionally after following up Podkletnov's findings.

40 An aircraft company announced that it had replicated Podkletnov's results.