READING PASSAGE 1

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

SECRETS OF THE SWARM

Insects, birds and fish tend to be the creatures that humans feel furthest from. Unlike many mammals they do not engage in human-like behaviour. The way they swarm or flock together does not usually get good press coverage either: marching like worker ants might be a common simile for city commuters, but it's a damning, not positive, image. Yet a new school of scientific theory suggests that these swarms might have a lot to teach us.

American author Peter Miller explains, 'I used to think that individual ants knew where they were going, and what they were supposed to do when they got there. But Deborah Gordon, a biologist at Stanford University, showed me that nothing an ant does makes any sense except in terms of the whole colony. Which makes you wonder if, as individuals, we don't serve a similar function for the companies where we work or the communities where we live.' Ants are not intelligent by themselves. Yet as a colony, they make wise decisions. And as Gordon discovered during her research, there's no one ant making decisions or giving orders.

Take food collecting, for example. No ant decides, 'There's lots of food around today; lots of ants should go out to collect it.' Instead, some forager ants go out, and as soon as they find food, they pick it up and come back to the nest. At the entrance, they brush past reserve foragers, sending a 'go out' signal. The faster the foragers come back, the more food there is and the faster other foragers go out, until gradually the amount of food being brought back diminishes. An organic calculation has been made to answer the question, 'How many foragers does the colony need today?' And if something goes wrong – a hungry lizard prowling around for an ant snack, for instance – then a rush of ants returning without food sends waiting reserves a 'Don't go out' signal.

But could such decentralised control work in a human organisation? Miller visited a Texas gas company that has successfully applied formulas based on ant colony behaviour to 'optimise its factories and route its trucks'. He explains, 'If ant colonies had worked out a reliable way to identify the best routes between their nest and food sources, the company managers figured, why not take advantage of that knowledge?' So they came up with a computer model, based on the self-organising principles of an ant colony. Data is fed into the model about deliveries needing to be made the next day, as well as things like weather conditions, and it produces a simulation determining the best route for the delivery lorries to take.

Miller explains that he first really understood the impact that swarm behaviour could have on humans when he read a study of honeybees by Tom Seeley, a biologist at Cornell University. The honeybees choose as a group which new nest to move to. First, scouts fly off to investigate multiple sites. When they return they do a 'waggle dance' for their spot, and other scouts will then fly off and investigate it. Many bees go out, but none tries to compare all sites. Each reports back on just one. The more they liked their nest, the more vigorous and

lengthy their waggle dance and the more bees will choose to visit it. Gradually the volume of bees builds up towards one site; it's a system that ensures that support for the best site snowballs and the decision is made in the most democratic way.

Humans, too, can make clever decisions through diversity of knowledge and a little friendly competition. 'The best example of shared decision-making that I witnessed during my research was a town meeting I attended in Vermont, where citizens met face-to-face to debate their annual budget,' explains Miller. 'For group decision-making to work well, you need a way to sort through the various options they propose; and you need a mechanism to narrow down these options.' Citizens in Vermont control their municipal affairs by putting forward proposals, or backing up others' suggestions, until a consensus is reached through a vote. As with the bees, the broad sampling of options before a decision is made will usually result in a compromise acceptable to all. The 'wisdom of the crowd' makes clever decisions for the good of the group – and leaves citizens feeling represented and respected.

The Internet is also an area where we are increasingly exhibiting swarm behaviour, without any physical contact. Miller compares a wiki website, for example, to a termite mound. Indirect collaboration is the key principle behind information-sharing web sites, just as it underlies the complex constructions that termites build. Termites do not have an architect's blueprint or a grand construction scheme. They simply sense changes in their environment, as for example when the mound's wall has been damaged, altering the circulation of air. They go to the site of the change and drop a grain of soil. When the next termite finds that grain, they drop theirs too. Slowly, without any kind of direct decision-making, a new wall is built. A termite mound, in this way, is rather like a wiki website. Rather than meeting up and talking about what we want to post online, we just add to what someone – maybe a stranger on the other side of the world – already wrote. This indirect knowledge and skill-sharing is now finding its way into the corridors of power.

Questions 1–6

Do the following statements agree with the information in the text?

In boxes 1–6 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*

1 Commuters are often compared favourably with worker ants.

2 Some ants within a colony have leadership roles.

3 Forager ants tell each other how far away the food source is.

4 Forager ants are able to react quickly to a dangerous situation.

5 Termite mounds can be damaged by the wind.

6 Termites repair their mounds without directly communicating with each other.

Questions 7–9

*Complete each sentence with the correct ending, **A–F**, below.*

*Write the correct letter, **A–F**, in boxes 7–9 on your answer sheet.*

7   Managers working for a Texas gas company

8   Citizens in an annual Vermont meeting

9   Some Internet users

A   provide support for each other's ideas in order to reach the best outcome.

B   use detailed comments to create large and complicated systems.

C   use decision-making strategies based on insect communities to improve their service.

D   communicate with each other to decide who the leader will be.

E   contribute independently to the ideas of others they do not know.

F   repair structures they have built without directly communicating with each other.
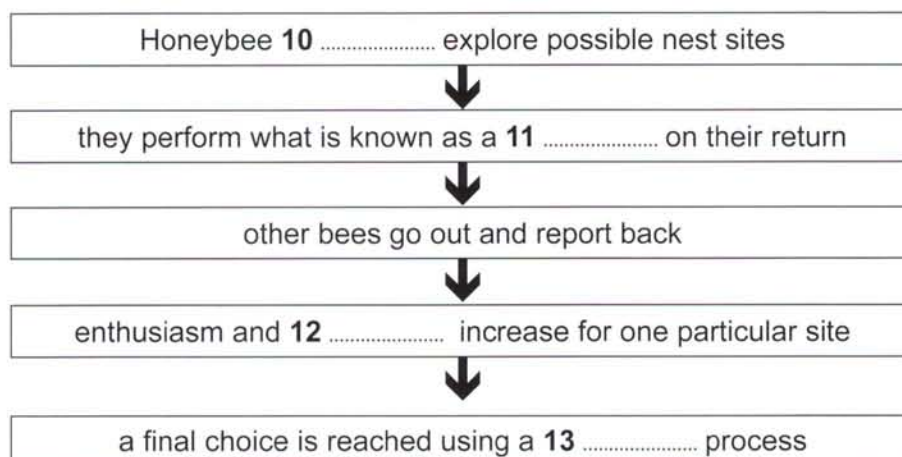
Questions 10–13

Complete the flow-chart below.

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

Write your answers in boxes 10–13 on your answer sheet.

How honeybees choose a new nest

Honeybee **10** .... explore possible nest sites

⬇

they perform what is known as a **11** .... on their return

⬇

other bees go out and report back

⬇

enthusiasm and **12** .... increase for one particular site

⬇

a final choice is reached using a **13** .... process

READING PASSAGE 2

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

Questions 14–18

The text on the following pages has five paragraphs, **A–E**.

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

*Write the correct number, **i–viii**, in boxes 14–18 on your answer sheet.*

List of Headings	
i	A joint business project
ii	Other engineering achievements
iii	Examining the overall benefits
iv	A building like no other
v	Some benefits of traditional methods
vi	A change of direction
vii	Examples of similar global brands
viii	From factory to building site

14 Paragraph A

15 Paragraph B

16 Paragraph C

17 Paragraph D

18 Paragraph E

High Speed, High Rise

A Chinese entrepreneur has figured out a way to manufacture 30-story, earthquake-proof skyscrapers that snap together in just 15 days.

A Zhang Yue is founder and chairman of Broad Sustainable Building (otherwise known as 'Broad') who, on 1 January, 2012, released a time-lapse video of its 30-story achievement. It shows construction workers buzzing around like gnats while a clock in the corner of the screen marks the time. In just 360 hours, a 100-metre-tall tower called the T30 rises from an empty site to overlook Hunan's Xiang River. At the end of the video, the camera spirals around the building overhead as the Broad logo appears on the screen: a lowercase b that wraps around itself in an imitation of the @ symbol. The company is in the process of franchising its technology to partners in India, Brazil, and Russia. What it is selling is the world's first standardized skyscraper and with it, Zhang aims to turn Broad into the McDonald's of the sustainable building industry. When asked why he decided to start a construction company, Zhang replies, 'It's not a construction company. It's a structural revolution.'

B So far, Broad has built 16 structures in China, plus another in Cancun. They are fabricated at two factories in Hunan, roughly an hour's drive from Broad Town, the sprawling headquarters. The floors and ceilings of the skyscrapers are built in sections, each measuring 15.6 by 3.9 meters with a depth of 45 centimeters. Pipes and ducts for electricity, water and waste are threaded through each floor module while it is still in the factory. The client's choice of flooring is also pre-installed on top. Standardized truckloads carry two modules each to the site with the necessary columns, bolts and tools to connect them stacked on top of each other. Once they arrive at the location, each section is lifted by crane directly to the top of the building, which is assembled like toy Lego bricks. Workers use the materials on the module to quickly connect the pipes and wires. The unique column design has diagonal bracing at each end and tabs that bolt into the floors above and below. In the final step, heavily insulated exterior walls and windows are slotted in by crane. The result is far from pretty but the method is surprisingly safe – and phenomenally fast.

C Zhang attributes his success to his creativity and to his outsider perspective on technology. He started out as an art student in the 1980s, but in 1988, Zhang left the art world to found Broad. The company started out as a maker of non-pressurized boilers. His senior vice-president, Juliet Jiang, says, 'He made his fortune on boilers. He could have kept doing this business, but … he saw the need for nonelectric air-conditioning.' Towards the end of the decade, China's economy was expanding past the capacity of the nation's electricity grid, she explains. Power shortages were becoming a serious obstacle to growth. Large air-conditioning (AC) units fueled by natural gas could help companies ease their electricity load, reduce overheads, and enjoy more reliable climate control into the bargain. Today, Broad has units operating in more than 70 countries, in some of the largest buildings and airports on the planet.

D For two decades, Zhang's AC business boomed. But a couple of events conspired to change his course. The first was that Zhang became an environmentalist. The second was the earthquake that hit China's Sichuan Province in 2008, causing the collapse of poorly constructed buildings. Initially, he says, he tried to convince developers to refit existing buildings to make them both more stable and more sustainable, but he had little success. So Zhang drafted his own engineers and started researching how to build cheap, environmentally friendly structures that could also withstand an earthquake. Within six months of starting his research, Zhang had given up on traditional methods. He was frustrated by the cost of hiring designers and specialists for each new structure. The best way to cut costs, he decided, was to take building to the factory. But to create a factory-built skyscraper, Broad had to abandon the principles by which skyscrapers are typically designed. The whole load-bearing structure had to be different. To reduce the overall weight of the building, it used less concrete in the floors; that in turn enabled it to cut down on structural steel.

E Around the world, prefabricated and modular buildings are gaining in popularity. But modular and prefabricated buildings elsewhere are, for the most part, low-rise. Broad is alone in applying these methods to skyscrapers. For Zhang, the environmental savings alone justify the effort. According to Broad's numbers, a traditional high-rise will produce about 3,000 tons of construction waste, while a Broad building will produce only 25 tons. Traditional buildings also require 5,000 tons of water onsite to build, while Broad buildings use none. The building process is also less dangerous. Elevator systems – the base, rails, and machine room – can be installed at the factory, eliminating the risk of injury. And instead of shipping an elevator car to the site in pieces, Broad orders a finished car and drops it into the shaft by crane. In the future, elevator manufacturers are hoping to preinstall the doors, completely eliminating any chance that a worker might fall. 'Traditional construction is chaotic,' he says. 'We took construction and moved it into the factory.' According to Zhang, his buildings will help solve the many problems of the construction industry and what's more, they will be quicker and cheaper to build.
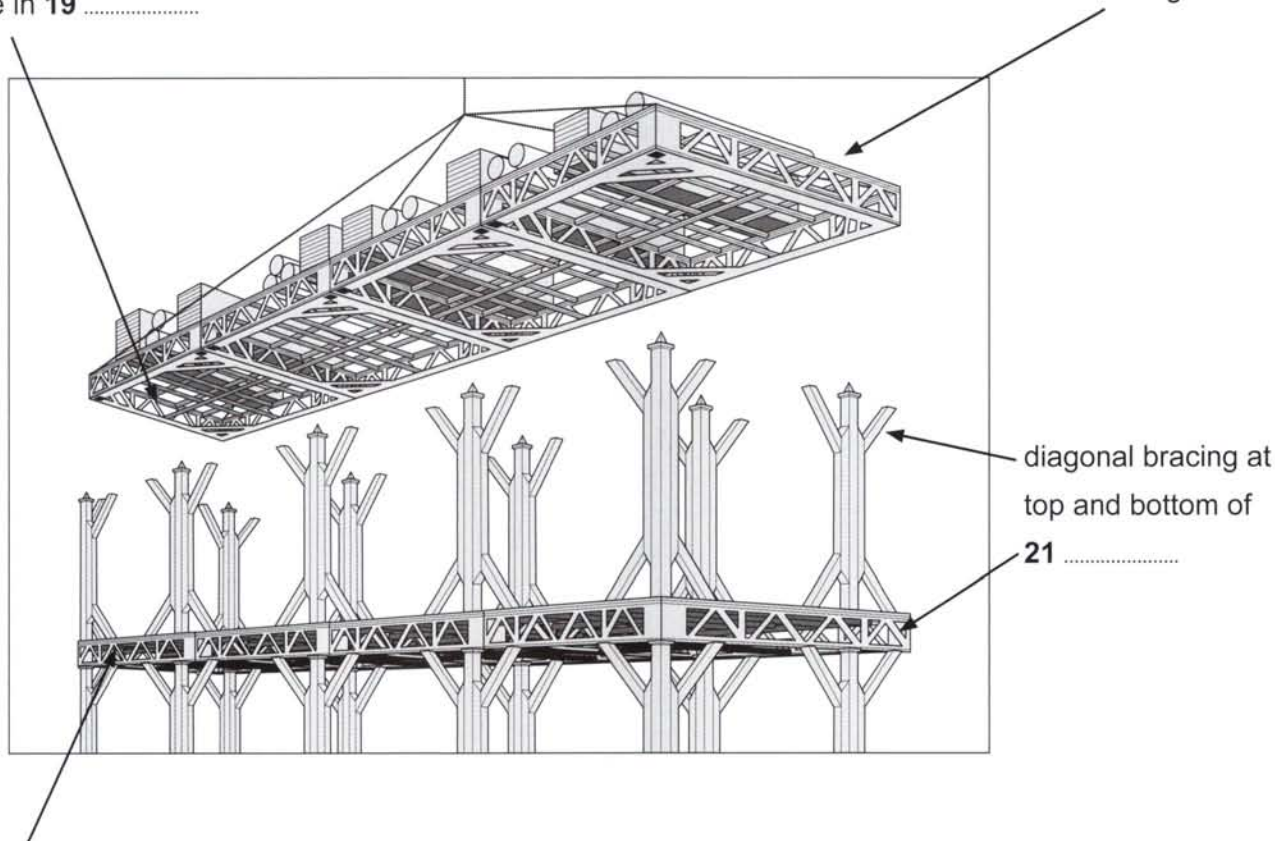
Questions 19–22

Label the diagram below.

*Choose **ONE WORD ONLY** from the text for each answer.*

Write your answers in boxes 19–22 on your answer sheet.

pipes and ducts installed
while in **19** ....

section contains less
22 .... than
conventional buildings

diagonal bracing at
top and bottom of
21 ....

20 .... chosen by customer

Questions 23–26

Complete the sentences below.

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

Write your answers in boxes 23–26 on your answer sheet.

23 Zhang refers to his business as a ....

24 The first products Broad manufactured were ....

25 In the late eighties, ... were holding back industrial progress in China.

26 In addition to power and cost benefits, Broad's AC units improve ....

READING PASSAGE 3

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

When conversations flow

We spend a large part of our daily life talking with other people and, consequently, we are very accustomed to the art of conversing. But why do we feel comfortable in conversations that have flow, but get nervous and distressed when a conversation is interrupted by unexpected silences? To answer this question we will first look at some of the effects of conversational flow. Then we will explain how flow can serve different social needs.

The positive consequences of conversational flow show some similarities with the effects of 'processing fluency'. Research has shown that processing fluency – the ease with which people process information – influences people's judgments across a broad range of social dimensions. For instance, people feel that when something is easily processed, it is more true or accurate. Moreover, they have more confidence in their judgments regarding information that came to them fluently, and they like things that are easy to process more than things that are difficult to process. Research indicates that a speaker is judged to be more knowledgeable when they answer questions instantly; responding with disfluent speech markers such as 'uh' or 'um' or simply remaining silent for a moment too long can destroy that positive image.

One of the social needs addressed by conversational flow is the human need for 'synchrony' – to be 'in sync' or in harmony with one another. Many studies have shown how people attempt to synchronize with their partners, by coordinating their behavior. This interpersonal coordination underlies a wide array of human activities, ranging from more complicated ones like ballroom dancing to simply walking or talking with friends.

In conversations, interpersonal coordination is found when people adjust the duration of their utterances and their speech rate to one another so that they can enable turn-taking to occur, without talking over each other or experiencing awkward silences. Since people are very well-trained in having conversations, they are often able to take turns within milliseconds, resulting in a conversational flow of smoothly meshed behaviors. A lack of flow is characterized by interruptions, simultaneous speech or mutual silences. Avoiding these features is important for defining and maintaining interpersonal relationships.

The need to belong has been identified as one of the most basic of human motivations and plays a role in many human behaviors. That conversational flow is related to belonging may be most easily illustrated by the consequences of flow disruptions. What happens when the positive experience of flow is disrupted by, for instance, a brief silence? We all know that silences can be pretty awkward, and research shows that even short disruptions in conversational flow can lead to a sharp rise in distress levels. In movies, silences are often used to signal non-compliance or confrontation (Piazza, 2006). Some researchers even argue that 'silencing someone' is one of the most serious forms of exclusion. Group membership is of elementary importance to our wellbeing and because humans are very sensitive to signals of exclusion, a silence is generally taken as a sign of rejection. In this way, a lack of flow in a conversation may signal that our relationship is not as solid as we thought it was.

Another aspect of synchrony is that people often try to validate their opinions to those

of others. That is, people like to see others as having similar ideas or worldviews as they have themselves, because this informs people that they are correct and their worldviews are justified. One way in which people can justify their worldviews is by assuming that, as long as their conversations run smoothly, their interaction partners probably agree with them. This idea was tested by researchers using video observations. Participants imagined being one out of three people in a video clip who had either a fluent conversation or a conversation in which flow was disrupted by a brief silence. Except for the silence, the videos were identical. After watching the video, participants were asked to what extent the people in the video agreed with each other. Participants who watched the fluent conversation rated agreement to be higher than participants watching the conversation that was disrupted by a silence, even though participants were not consciously aware of the disruption. It appears that the subjective feeling of being out of sync informs people of possible disagreements, regardless of the content of the conversation.

Because people are generally so well-trained in having smooth conversations, any disruption of this flow indicates that something is wrong, either interpersonally or within the group as a whole. Consequently, people who do not talk very easily may be incorrectly understood as being less agreeable than those who have no difficulty keeping up a conversation. On a societal level, one could even imagine that a lack of conversational flow may hamper the integration of immigrants who have not completely mastered the language of their new country yet. In a similar sense, the ever-increasing number of online conversations may be disrupted by misinterpretations and anxiety that are produced by insuperable delays in the Internet connection. Keeping in mind the effects of conversational flow for feelings of belonging and validation may help one to be prepared to avoid such misunderstandings in future conversations.

Questions 27–32

Do the following statements agree with the claims of the writer in the text?

In boxes 27–32 on your answer sheet, write

> **YES**   *if the statement agrees with the claims of the writer*
> **NO**   *if the statement contradicts the claims of the writer*
> **NOT GIVEN**   *if it is impossible to say what the writer thinks about this*

27 Conversation occupies much of our time.

28 People assess information according to how readily they can understand it.

29 A quick response to a question is thought to show a lack of knowledge.

30 Video observations have often been used to assess conversational flow.

31 People who talk less often have clearer ideas than those who talk a lot.

32 Delays in online chat fail to have the same negative effect as disruptions that occur in natural conversation.

Questions 33–40

Complete the summary below.

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

Write your answers in boxes 33–40 on your answer sheet.

Synchrony

There is a human desire to co-ordinate **33** .... in an effort to be 'in harmony'. This co-ordination can be seen in conversations when speakers alter the speed and extent of their speech in order to facilitate **34** .... This is often achieved within milliseconds: only tiny pauses take place when a conversation flows; when it doesn't, there are **35** .... and silences, or people talk at the same time.

Our desire to **36** .... is also an important element of conversation flow. According to research, our **37** .... increase even if silences are brief. Humans have a basic need to be part of a group, and they experience a sense of **38** .... if silences exclude them.

People also attempt to co-ordinate their opinions in conversation. In an experiment, participants' judgement of the overall **39** .... among speakers was tested using videos of a fluent and a slightly disrupted conversation. The results showed that the **40** .... of the speakers' discussion was less important than the perceived synchrony of the speakers.