**Islamic Art and the Book**

The arts of the Islamic book, such as calligraphy and decorative drawing, developed during A.D. 900 to 1500, and luxury books are some of the most characteristic examples of Islamic art produced in this period. This came about from two major developments: paper became common, replacing parchment as the major medium for writing, and rounded scripts were regularized and perfected so that they replaced the angular scripts of the previous period, which because of their angularity were uneven in height. Books became major vehicles for artistic expression, and the artists who produced them, notably calligraphers and painters, enjoyed high status, and their workshops were often sponsored by princes and their courts. Before A.D. 900, manuscripts of the Koran (the book containing the teachings of the Islamic religion) seem to have been the most common type of book produced and decorated, but after that date a wide range of books were produced for a broad spectrum of patrons. These continued to include, of course, manuscripts of the Koran, which every Muslim wanted to read, but scientific works, histories, romances, and epic and lyric poetry were also copied in fine handwriting and decorated with beautiful illustrations. Most were made for sale on the open market, and cities boasted special souks (markets) where books were bought and sold. The mosque of Marrakech in Morocco is known as the Kutubiyya, or Booksellers' Mosque, after the adjacent market. Some of the most luxurious books were specific commissions made at the order of a particular prince and signed by the calligrapher and decorator.

Papermaking had been introduced to the Islamic lands from China in the eighth century. It has been said that Chinese papermakers were among the prisoners captured in a battle fought near Samarqand between the Chinese and the Muslims in 751, and the technique of papermaking – in which cellulose pulp extracted from any of several plants is first suspended in water, caught on a fine screen, and then dried into flexible sheets – slowly spread westward. Within fifty years, the government in Baghdad was using paper for documents. Writing in ink on paper, unlike parchment, could not easily be erased, and therefore paper had the advantage that it was difficult to alter what was written on it. Papermaking spread quickly to Egypt – and eventually to Sicily and Spain – but it was several centuries before paper supplanted parchment for copies of the Koran, probably because of the conservative nature of religious art and its practitioners. In western Islamic lands, parchment continued to be used for manuscripts of the Koran throughout this period.

The introduction of paper spurred a conceptual revolution whose consequences have barely been explored. Although paper was never as cheap as it has become today, it was far less expensive than parchment, and therefore more people could afford to buy books, Paper is thinner than parchment, so more pages could be enclosed within a single volume. At first, paper was made in relatively small sheets that were pasted together, but by the beginning of the fourteenth century, very large sheets – as much as a meter across – were available. These large sheets meant that calligraphers and artists had more space on which to work. Paintings became more complicated, giving the artist greater opportunities to depict space or emotion. The increased availability of paper, particularly after 1250, encouraged people to develop systems of representation, such as architectural plans and drawings. This in turn allowed the easy transfer of artistic ideas and motifs over great distances from one medium to another, and in a different scale in ways that had been difficult, if not impossible, in the previous period.

Rounded styles of Arabic handwriting had long been used for correspondence and documents alongside the formal angular scripts used for inscriptions and manuscripts of the Koran. Around the year 900, Ibn Muqla, who was a secretary and vizier at the Abbasid court in Baghdad, developed a system of proportioned writing. He standardized the length of alif, the first letter of the Arabic alphabet, and then determined what the size and shape of all other letters should be, based on the alif. Eventually, six round forms of handwriting, composed of three pairs of big and little scripts known collectively as the Six Pens, became the standard repertory of every calligrapher.

Paragraph 1 makes all of the following points about Islamic books EXCEPT:

|  |  |
| --- | --- |
| A | Books were an important form of artistic expression. |
| B | A wide variety of books with different styles and topics became available. |
| C | They were sold primarily near mosques. |
| D | Most books were intended for sale on the open market. |

The word "sponsored" in the passage is closest in meaning to

|  |  |
| --- | --- |
| A | visited |
| B | owned |
| C | praised |
| D | supported |

The word "adjacent" in the passage is closest in meaning to

|  |  |
| --- | --- |
| A | major |
| B | nearby |
| C | ancient |
| D | well-known |

According to paragraph 1, before A.D. 900, books in the Islamic world

|  |  |
| --- | --- |
| A | included a wide range of subjects |
| B | did not contain any calligraphy or decoration |
| C | used rounded scripts |
| D | were usually written on parchment |

In paragraph 1, why does the author mention the fact that the mosque in Marrakech,  
Morocco, is known as the Booksellers’ Mosque

|  |  |
| --- | --- |
| A | To cast doubt on the importance of souks in making books available to common people |
| B | To provide an example of a place where books were made at the order of a particular prince |
| C | To emphasize how influential and well known the book markets were |
| D | To demonstrate the need for religious texts in Islamic lands |

The phrase "extracted from" in the passage is closest in meaning to

|  |  |
| --- | --- |
| A | taken out of |
| B | produced using |
| C | discovered in |
| D | combined with |

Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

|  |  |
| --- | --- |
| A | It was several centuries before papermaking techniques spread to faraway areas where parchment was popular and used widely in art. |
| B | Although papermaking came to Egypt quickly, it took much longer for paper to be used when copying the Koran, probably because of the conservative nature of religious art. |
| C | Papermaking spread beyond Egypt, Sicily, and Spain, but it was not widely used by artists for centuries, probably because of the conservative nature of art in those countries. |
| D | Paper replaced parchment in copies of the Koran, probably at the request of conservative practitioners in areas like Egypt, Sicily, and Spain. |

In paragraphs 2 and 3, which of the following is NOT mentioned as an advantage of  
paper over parchment?

|  |  |
| --- | --- |
| A | It was harder to erase or change what was written on paper. |
| B | More pages of paper could be bound in a single volume. |
| C | Paper could be produced in sheets of varying weights and thicknesses. |
| D | More people could buy books made of paper because it was cheaper. |

Why does the author include the following information:"At first, paper was made in  
relatively small sheets that were pasted together, but by the beginning of the fourteenth century, very large sheets – as much as a meter across – were available."?

|  |  |
| --- | --- |
| A | To provide evidence that the development of papermaking techniques was very slow |
| B | To explain why paper was never as cheap as it has become today |
| C | To make the point that paper allowed artists to develop paintings that were more expressive and complex |
| D | To prove that paper was more popular with artists who used large sheets, than it was with book printers, who used smaller sheets |

According to paragraph 3, the increased availability of paper and the development of  
systems of representation

|  |  |
| --- | --- |
| A | encourage more people to make their own drawings |
| B | made the transfer of artistic ideas to distant people and places much easier |
| C | made architectural plans more complex and therefore harder to read |
| D | allowed artists to create paintings that were smaller in scale |

According to paragraph 4, what did Ibn Muqla achieve around the year 900?

|  |  |
| --- | --- |
| A | He modified a set of formal scripts known as the Six Pens into rounded scripts appropriate for correspondence. |
| B | He created a standardized set of rounded scripts proportional to the size of the first letter of the alphabet. |
| C | He promoted calligraphy as an art form and encouraged the use of rounded letters in religious texts. |
| D | He persuaded the court in Baghdad to use rounded styles instead of more angular scripts in their documents. |

The phrase "composed of" in the passage is closest in meaning to

|  |  |
| --- | --- |
| A | made up of |
| B | developed from |
| C | in addition to |
| D | similar to |

This change occurred for good reason.

|  |  |
| --- | --- |
| A | 1 |
| B | 2 |
| C | 3 |
| D | 4 |

**Directions:** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage.**This question is worth 2 points.**

Islamic books from A.D. 900 to 1500 reflect major changes from the past and important innovations.

**1**Books became major vehicle of artistic expression for calligraphers and painters, and the subjects of books expanded to include more and more kinds of works.

**2**The growing luxuriousness of books meant that the market for them was increasingly dominated by the wealthy and powerful patrons who could afford them.

**3**After it was learned from Chinese prisoners, the technique of papermaking spread throughout Islamic lands, where paper gradually replaced parchment.

**4**The high status enjoyed by calligraphers and artists made books extremely popular in the cities where books were bought and sold.

**5**The popularity of books led to major advances in the development and transfer of new artistic ideas.

**6**Around the year 900, a set of rounded styles of Arabic handwriting began replacing angular scripts in copying the manuscripts of the Koran.

**The Development of Steam Power**

By the eighteenth century, Britain was experiencing a severe shortage of energy. Because of the growth of population, most of the great forests of medieval Britain had long ago been replaced by fields of grain and hay. Wood was in ever-shorter supply, yet it remained tremendously important. It served as the primary source of heat for all homes and industries and as a basic raw material. Processed wood (charcoal) was the fuel that was mixed with iron ore in the blast furnace to produce pig iron (raw iron). The iron industry's appetite for wood was enormous, and by 1740 the British iron industry was stagnating. Vast forests enabled Russia to become the world's leading producer of iron, much of which was exported to Britain. But Russia's potential for growth was limited too, and in a few decades Russia would reach the barrier of inadequate energy that was already holding England back.

As this early energy crisis grew worse, Britain looked toward its abundant and widely scattered reserves of coal as an alternative to its vanishing wood. Coal was first used in Britain in the late Middle Ages as a source of heat. By 1640 most homes in London were heated with it, and it also provided heat for making beer, glass, soap, and other products. Coal was not used, however, to produce mechanical energy or to power machinery. It was there that coal's potential wad enormous.

As more coal was produced, mines were dug deeper and deeper and were constantly filling with water. Mechanical pumps, usually powered by hundreds of horses waling in circles at the surface, had to be installed. Such power was expensive and bothersome. In an attempt to overcome these disadvantages, Thomas Savery in 1698 and Thomas Newcomen in 1705 invented the first primitive steam engines. Both engines were extremely inefficient. Both burned coal to produce steam, which was then used to operate a pump. However, by the early 1770s, many of the Savery engines and hundreds of the Newcomen engines were operating successfully, though inefficiently, in English and Scottish mines.

In the early 1760s, a gifted young Scot named James Watt was drawn to a critical study of the steam engine. Watt was employed at the time by the University of Glasgow as a skilled crafts worker making scientific instruments. In 1763, Watt was called on to repair a Newcomen engine being used in a physics course. After a series of observations, Watt saw that the New comen's waste of energy could be reduced by adding a separate condenser. This splendid invention, patented in 1769, greatly increased the efficiency of the steam engine. The steam engine of Watt and his followers was the technological advance that gave people, at least for a while, unlimited power and allowed the invention and use of all kinds of power equipment.

The steam engine was quickly put to use in several industries in Britain. It drained mines and made possible the production of ever more coal to feed steam engines elsewhere. The steam power plant began to replace waterpower in the cotton-spinning mills as well as other industries during the 1780s, contributing to a phenomenal rise in industrialization. The British iron industry was radically transformed. The use of powerful, steam-driven bellows in blast furnaces helped iron makers switch over rapidly from limited charcoal to unlimited coke (which is made from coal) in the smelting of pig iron (the process of refining impure iron) after 1770 in the 1780s, Henry Cort developed the puddling furnace, which allowed pig iron to be refined in turn with coke. Cort also developed heavy-duty, steam-powered rolling mills, which were capable of producing finished iron in every shape and form.

The economic consequence of these technical innovations in steam power was a great boom in the British iron industry. In 1740 annual British iron production was only 17,000 tons, but by 1844, with the spread of coke smelting and the impact of Cort's inventions, it had increased to 3,000,000 tons. This was a truly amazing expansion. Once scarce and expensive, iron became cheap, basic, and indispensable to the economy.

What can be inferred from paragraph 1 about Britain's short supply of wood in the  
eighteenth century?

|  |  |
| --- | --- |
| A | Wood from Britain's great forests was being exported to other countries for profit. |
| B | A growing population had required cutting down forests to increase available land for farming. |
| C | Larger families required the construction of larger homes made from wood. |
| D | What was left of the great forests after the medieval period was being strictly protected. |

Select TWO answer choices that, according to paragraph 1, are true statements about Russia's iron industry in the eighteenth century. To obtain credit, you must select TWO answer choices.

|  |  |
| --- | --- |
| A | Russia reached its maximum production of iron at the same time as Britain. |
| B | Russia exported much of its iron production to Britain. |
| C | Russia's appetite for iron increased rapidly after 1740. |
| D | Russia's energy resources eventually became insufficient and limited the growth of its iron industry. |

The word "abundant" in the passage is closest in meaning to

|  |  |
| --- | --- |
| A | reliable |
| B | plentiful |
| C | well-preserved |
| D | existing |

Why are "beer, glass, soap, and other products" mentioned in the discussion of  
Britain's energy?

|  |  |
| --- | --- |
| A | To help explain why the energy crisis was so severe |
| B | To show that despite the energy crisis and as early as 1640, London homes were advanced and well supplied |
| C | To emphasize that after 1640, British homes required energy for more than heat |
| D | To indicate that coal had been used for the production of certain products before the eighteenth century |

According to paragraph 3, all of the following are ways in which the Savery and Newcomen engines were similar EXCEPT:

|  |  |
| --- | --- |
| A | Both became relatively inexpensive after the 1770s. |
| B | Both produced steam by burning coal. |
| C | Both were used to operate pumps. |
| D | Both were very inefficient. |

The word "gifted" in the passage is closest in meaning to

|  |  |
| --- | --- |
| A | independent |
| B | talented |
| C | famous |
| D | ambitious |

According to paragraph 4, what was James Watt's major achievement?

|  |  |
| --- | --- |
| A | He was able to apply his understanding of physics to invent a variety of scientific instruments and tools for skilled crafts workers. |
| B | He taught university physics courses to outstanding students whose observations led to many patented inventions. |
| C | He improved the efficiency of Newcomen's engine by preventing energy from being lost. |
| D | He redesigned Newcomen's engine so that it no longer needed a separate condenser. |

The word "splendid" in the passage is closest in meaning to

|  |  |
| --- | --- |
| A | original |
| B | necessary |
| C | magnificent |
| D | popular |

Which of the following is NOT mentioned in paragraph 5 as a development that  
greatly changed the production of iron?

|  |  |
| --- | --- |
| A | The use of coke in the smelting of pig iron |
| B | The invention of a furnace that used coke to refine iron |
| C | The discovery of a method for increasing the production of charcoal |
| D | The invention of powerful machinery that could shape, form, and finish iron |

In paragraph 6, why does the author compare British iron production in 1740 with  
that of 1844?

|  |  |
| --- | --- |
| A | To contrast the amounts of iron needed in Britain in two different centuries |
| B | To illustrate how easy it was to make money using Cort's invention |
| C | To demonstrate the tremendous growth of the iron industry in Britain |
| D | To demonstrate how inexpensive coal had become |

The word "indispensable" in the passage is closest in meaning to

|  |  |
| --- | --- |
| A | advantageous |
| B | essential |
| C | less costly |
| D | highly stimulating |

According to the passage, which of the following is true about the development of  
steam power?

|  |  |
| --- | --- |
| A | The steam engine's basic technology can be traced back to medieval Britain when steam-powered machinery was being tried in farming activities. |
| B | Although Russia and Britain developed steam-power technology simultaneously, Britain was first to try it in a large-scale industry due to a greater need for iron. |
| C | Steam-power technology was largely the result of improvements developed to increase the supply of coal as a primary source of energy. |
| D | Adaptations to steam engines required for their use in cotton-spinning mills led to radical developments in machinery used in the iron industry. |

Energy had not been a problem for Britain in the past because it relied on a rich  
source of energy: its vast forests.

|  |  |
| --- | --- |
| A | 1 |
| B | 2 |
| C | 3 |
| D | 4 |

**Directions:** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage.**This question is worth 2 points.**

By the eighteenth century, Britain was experiencing a severe shortage of energy.

**1**The development of blast furnaces for the manufacture of pig iron made the Britain less dependent on wood.

**2**After the medieval period, both Russia and Britain began to look for alternative sources of energy, such as steam power, in order to maintain the growth of their iron industries.

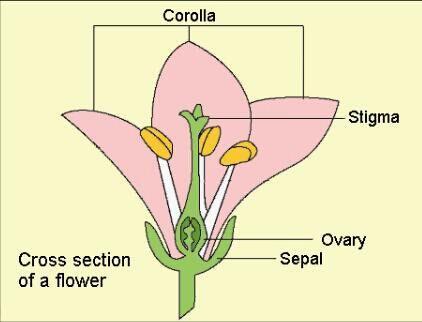
**3**Two inventors designed the first steam engines in order to overcome the disadvantages of relying on horses to power the pumps used in mining coal.

**4**James Watt was able to improve upon the efficiency of the steam engine and make it useful to several industries.

**5**The puddling furnace increased the availability of charcoal to a variety of industries from cotton to iron production.

**6**Steam power increased coal production, which in turn allowed extraordinary growth of the iron industry and the British economy.

**Protection of Plants by Insects**



Many plants – one or more species of at least 68 different families – can secrete nectar even when they have no blossoms, because they bear extrafloral nectaries (structures that produce nectar) on stems, leaves, leaf stems, or other structures. These plants usually occur where ants are abundant, most in the tropics but some in temperate areas. Among those of northeastern North America are various plums, cherries, roses, hawthorns, poplars, and oaks. Like floral nectar, extrafloral nectar consists mainly of water with a high content of dissolved sugars and, in some plants, small amounts of amino acids. The extrafloral nectaries of some plants are known to attract ants and other insects, but the evolutionary history of most plants with these nectaries is unknown. Nevertheless, most ecologists believe that all extrafloral nectaries attract insects that will defend the plant.

Ants are portably the most frequent and certainly the most persistent defenders of plants. Since the highly active worker ants require a great deal of energy, plants exploit this need by providing extrafloral nectar that supplies ants with abundant energy. To return this favor, ants guard the nectaries, driving away or killing intruding insects that might compete with ants for nectar. Many of these intruders are herbivorous and would eat the leaves of the plants.

Biologists once thought that secretion of extrafloral nectar has some purely internal physiological function, and that ants provide no benefit whatsoever to the plants that secrete it. This view and the opposing "protectionist" hypothesis that ants defend plants had been disputed for over a hundred years when, in 1910, a skeptical William Morton Wheeler commented on the controversy. He called for proof of the protectionist view: that visitations of the ants confer protection on the plants and that in the absence of the insects a much greater number would perish or fail to produce flowers or seeds than when the insects are present. That we now have an abundance of the proof that was called for was established when Barbara Bentley reviewed the relevant evidence in 1977, and since then many more observations and experiments have provided still further proof that ants benefit plants.

One example shows how ants attracted to extrafloral nectaries protect morning glories against attacking insects. The principal insect enemies of the North American morning glory feed mainly on its flowers or fruits rather than its leaves. Grasshoppers feeding on flowers indirectly block pollination and the production of seeds by destroying the corolla or the stigma, which receives the pollen grains and on which the pollen germinates. Without their colorful corolla, flowers do not attract pollinators and are not fertilized. An adult grasshopper can consume a large corolla, about 2.5 inches long, in an hour. Caterpillars and seed beetles affect seed production directly. Caterpillars devour the ovaries, where the seeds are produced, and seed beetle larvae eat seeds as they burrow in developing fruits.

Extrafloral nectaries at the base of each sepal attract several kinds of insects, but 96 percent of them are ants, several different species of them. When buds are still small, less than a quarter of an inch long, the sepal nectaries are already present and producing nectar. They continue to do so as the flower develops and while the fruit matures. Observations leave little doubt that ants protect morning glory flowers and fruits from the combined enemy force of grasshoppers, caterpillars, and seed beetles. Bentley compares the seed production of six plants that grew where there were no ants with that of seventeen plants that were occupied by ants. Unprotected plants bore only 45 seeds per plant, but plants occupied by ants bore 211 seeds per plant. Although ants are not big enough to kill or seriously injure grasshoppers, they drive them away by nipping at their feet. Seed beetles are more vulnerable because they are much smaller than grasshoppers. The ants prey on the adult beetles, disturb females as they lay their eggs on developing fruits, and eat many of the eggs they do manage to lay.

According to paragraph 1, floral nectar and extrafloral nectar are alike in that

|  |  |
| --- | --- |
| A | they are likely to be produced by the same plants |
| B | they basically consist of the same chemical components |
| C | they attract only insects that will defend the plant |
| D | they are produced by the same parts of the plant |

To say that ants are "persistent" defenders of plants means that

|  |  |
| --- | --- |
| A | they defend plants against a wide variety of threats |
| B | they continue to defend plants for as long as the plants are threatened |
| C | they are successful defenders of plants |
| D | they are easily observable defenders of plants |

What can be inferred from paragraph 2 about the ants that are attracted to the  
extrafloral nectaries?

|  |  |
| --- | --- |
| A | They do not eat the leaves of the plants that produce extrafloral nectar. |
| B | They live almost entirely on extrafloral nectar. |
| C | They spend most of their energy guarding extrafloral nectaries. |
| D | They frequently fight among themselves over extrafloral nectar. |

According to paragraph 3, what was the position of the opponents of the "protectionist" hypothesis?

|  |  |
| --- | --- |
| A | Extrafloral nectar provides plants with a direct defense against attack by insects. |
| B | Ants substantially benefit plants that secrete extrafloral nectar. |
| C | The secretion of extrafloral nectar plays a role in the plant's internal functioning. |
| D | Ants visit plants that secrete extrafloral nectar as often as they visit plants that do not. |

The word "skeptical" in the passage is closest in meaning to

|  |  |
| --- | --- |
| A | curious |
| B | doubtful |
| C | open-minded |
| D | practical |

Which of the sentences below best expresses the essential information in the  
highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

|  |  |
| --- | --- |
| A | We now have ample proof that ants benefit plants. |
| B | Barbara Bentley has called for additional proof that ants benefit plants. |
| C | In 1977 Barbara Bentley conducted research that proved that all prior studies were wrong. |
| D | Proof that ants benefit plants will require many more observations and experiments. |

According to paragraph 4, what effect does the destruction of the corolla have on  
plants?

|  |  |
| --- | --- |
| A | It leaves the seeds exposed and unprotected. |
| B | It prevents the stigma from developing. |
| C | It keeps pollen grains from attaching properly. |
| D | It prevents the flower from attracting pollinators. |

The word "devour" in the passage is closest in meaning to

|  |  |
| --- | --- |
| A | attack |
| B | eat |
| C | damage |
| D | prefer |

What role does paragraph 5 play in the passage?

|  |  |
| --- | --- |
| A | It offers various kinds of evidence for the protectionist view. |
| B | It presents the study that first proved that ants benefit plants. |
| C | It explains how insects find sources of nectar. |
| D | It presents information that partly contradicts the protectionist view. |

The word "vulnerable" in the passage is closest in meaning to

|  |  |
| --- | --- |
| A | numerous |
| B | harmful |
| C | open to attack |
| D | difficult to locate |

According to paragraph 5, what did Bentley's comparative study show?

|  |  |
| --- | --- |
| A | Many more plants grew in places where ants were present than where they were absent. |
| B | The ants preferred plants with low seed production to plants with high seed production. |
| C | The plants occupied by ants produced many more seeds than those that were not occupied by ants. |
| D | The plants that grew in places without ants were much smaller and weaker than those that grew in places where ants were present. |

According to paragraph 5, ants defend morning glory plants from seed beetles in each of the following ways EXCEPT

|  |  |
| --- | --- |
| A | driving adult beetles off the plants by nipping at their feet |
| B | catching and eating adult beetles |
| C | eating beetle eggs they find on developing fruits |
| D | making it difficult for beetles to lay eggs on developing fruits |

Sometimes they capture the insects to feed their protein-hungry larvae.

|  |  |
| --- | --- |
| A | 1 |
| B | 2 |
| C | 3 |
| D | 4 |

**Directions:** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage.**This question is worth 2 points.**

Many plants have extrafloral nectaries that produce nectar even during periods in which the plant is not flowering.

**1**Evolutionary history shows that plants that produce extrafloral nectar originated in the tropics.

**2**Extrafloral nectar has a higher concentration of sugar than floral nectar and is more attractive to ants and other insects.

**3**The protectionist hypothesis is that extrafloral nextar attracts ants, and that the ants, in order to preserve this energy-rich food source, attack insects that might harm the plant.

**4**Evidence accumulated during the twentieth century proved that ants provide significant benefits for plants with extrafloral nectaries.

**5**Research has shown that American morning glory plants that are protected by ants produce significantly more seeds than morning glory plants that are not protected by ants.

**6**Ants generally ignore small insects, but they will eat the adults of large insect species as well as their eggs and larvae.