

## A spark, a flint: How fire leapt to life

The control of fire was the first and perhaps greatest of humanity's steps towards a life-enhancing technology. To early man, fire was a divine gift randomly delivered in the form of lightning, forest fire or burning lava.

Unable to make flame for themselves, the earliest people probably stored fire by keeping slow burning logs alight or by carrying charcoal in pots. How and where man learnt how to produce flame at will is unknown. It was probably a secondary invention, accidentally made during tool-making operations with wood or stone. Studies of primitive societies suggest that the earliest method of making fire was through friction. European peasants would insert a wooden drill in a round hole and rotate it briskly between their palms this process could be speeded up by wrapping a cord around the drill and pulling on each end.

The Ancient Greeks used lenses or concave mirrors to concentrate the sun's rays and burning glasses were also used by Mexican Aztecs and the Chinese.

Percussion methods of fire-lighting date back to Paleolithic times, when some Stone Age tool-makers discovered that chipping flints produced sparks. The technique became more efficient after the discovery of iron, about 5000 years ago. In Arctic North America, the Eskimos produced a slow-burning spark by striking quartz against iron pyrites, a compound that contains sulphur. The Chinese lit their fires by striking porcelain with bamboo. In Europe, the combination of steel, flint and tinder remained the main method of fire-lighting until the mid 19th century.

Fire-lighting was revolutionised by the discovery of phosphorus, isolated in 1669 by a German alchemist trying to transmute silver into gold. Impressed by the element's combustibility, several 17th century chemists used it to manufacture fire-lighting devices, but the results were dangerously inflammable. With phosphorus costing the equivalent of several hundred pounds per ounce, the first matches were expensive.

The quest for a practical match really began after 1781 when a group of French chemists came up with the Phosphoric Candle or Ethereal Match, a sealed glass tube containing a twist of paper tipped with phosphorus. When the tube was broken, air rushed in, causing the phosphorus to self-combust. An even more hazardous device, popular in America, was the Instantaneous Light Box — a bottle filled with sulphuric acid into which splints treated with chemicals were dipped.

The first matches resembling those used today were made in 1827 by John Walker, an English pharmacist who borrowed the formula from a military rocket-maker called Congreve. Costing a shilling a box, Congreves were splints coated with sulphur and tipped with potassium chlorate. To light them, the user drew them quickly through folded glass paper.

Walker never patented his invention, and three years later it was copied by a Samuel Jones, who marketed his product as Lucifers. About the same time, a French chemistry student called Charles Sauria produced

the first “strike-anywhere” match by substituting white phosphorus for the potassium chlorate in the Walker formula. However, since white phosphorus is a deadly poison, from 1845 match-makers exposed to its fumes succumbed to necrosis, a disease that eats away jaw-bones. It wasn’t until 1906 that the substance was eventually banned.

That was 62 years after a Swedish chemist called Pasch had discovered non-toxic red or amorphous phosphorus, a development exploited commercially by Pasch’s compatriot J E Lundstrom in 1885. Lundstrom’s safety matches were safe because the red phosphorus was non-toxic; it was painted on to the striking surface instead of the match tip, which contained potassium chlorate with a relatively high ignition temperature of 182 degrees centigrade.

America lagged behind Europe in match technology and safety standards. It wasn’t until 1900 that the Diamond Match Company bought a French patent for safety matches — but the formula did not work properly in the different climatic conditions prevailing in America and it was another 11 years before scientists finally adapted the French patent for the US.

The Americans, however, can claim several “firsts” in match technology and marketing. In 1892 the Diamond Match Company pioneered book matches. The innovation didn’t catch on until after 1896, when a brewery had the novel idea of advertising its product in match books. Today book matches are the most widely used type in the US, with 90 percent handed out free by hotels, restaurants and others.

Other American innovations include an anti-afterglow solution to prevent the match from smoldering after it has been blown out; and the waterproof match, which lights after eight hours in water.

#### Questions 1-8

Complete the summary below. Choose your answers from the box given below and write them in boxes 1-8 on your answer sheet.

NB There are more words than spaces so you will not use them all you may use any of the words more than once.

#### EARLY FIRE-LIGHTING METHODS

They tried to (1).....burning logs or charcoal (2)..... that they could create fire themselves. It is suspected that the first man-made flames were produced by (3).....The very first fire-lighting methods involved the creation of (4).....by, for example, rapidly (5)..... a wooden stick in a round hole. The use of (6)..... or persistent chipping was also widespread in Europe and among other peoples such as the Chinese and (7)..... European practice of this method continued until the 1850s (8).....the discovery of phosphorus some years earlier.

List of Words		
Mexicans	random	rotating
despite	preserve	<u>realising</u>
sunlight	lacking	heavenly
percussion	chance	friction
unaware	without	make
heating	Eskimos	surprised
until	smoke	

### Questions 9-15

Look at the following notes that have been made about the matches described in Reading Passage 1. Decide which type of match (A-H) corresponds with each description and write your answers in boxes 9-15 on your answer sheet.

NB There are more matches than descriptions so you will not use them all. You may use any match more than once.

### Notes

- 9. made using a less poisonous type of phosphorus
- 10. identical to a previous type of match
- 11. caused a deadly illness
- 12. first to look like modern matches
- 13. first matches used for advertising
- 14. relied on an airtight glass container
- 15. made with the help of an army design

### Types of Matches

- A. the Ethereal Match
- B. the Instantaneous Lightbox
- C. Congreves
- D. Lucifers
- E. the first strike anywhere match
- F. Lundstrom's safety match
- G. book matches
- H. waterproof matches

## Zoo conservation programmes

One of London Zoo's recent advertisements caused me some irritation, so patently did it distort reality. Headlined "Without zoos you might as well tell these animals to get stuffed", it was bordered with illustrations of several endangered species and went on to extol the myth that without zoos like London Zoo these animals "will almost certainly disappear forever". With the zoo world's rather mediocre record on conservation, one might be forgiven for being slightly sceptical about such an advertisement.

Zoos were originally created as places of entertainment, and their suggested involvement with conservation didn't seriously arise until about 30 years ago, when the Zoological Society of London held the first formal international meeting on the subject. Eight years later, a series of world conferences took place, entitled "The Breeding of Endangered Species", and from this point onwards conservation became the zoo community's buzzword. This commitment has now been clearly defined in The World Zoo Conservation Strategy (WZGS, September 1993), which although an important and welcome document does seem to be based on an unrealistic optimism about the nature of the zoo industry.

The WZCS estimates that there are about 10,000 zoos in the world, of which around 1,000 represent a core of quality collections capable of participating in co-ordinated conservation programmes. This is probably the document's first failing, as I believe that 10,000 is a serious underestimate of the total

number of places masquerading as zoological establishments. Of course it is difficult to get accurate data but, to put the issue into perspective, I have found that, in a year of working in Eastern Europe, I discover fresh zoos on almost a weekly basis.

The second flaw in the reasoning of the WZCS document is the naive faith it places in its 1,000 core zoos. One would assume that the calibre of these institutions would have been carefully examined, but it appears that the criterion for inclusion on this select list might merely be that the zoo is a member of a zoo federation or association. This might be a good starting point, working on the premise that members must meet certain standards, but again the facts don't support the theory. The greatly respected American Association of Zoological Parks and Aquariums (AAZPA) has had extremely dubious members, and in the UK the Federation of Zoological Gardens of Great Britain and Ireland has occasionally had members that have been roundly censured in the national press. These include Robin Hill Adventure Park on the Isle of Wight, which many considered the most notorious collection of animals in the country. This establishment, which for years was protected by the Isle's local council (which viewed it as a tourist amenity), was finally closed down following a damning report by a veterinary inspector appointed under the terms of the Zoo Licensing Act 1981. As it was always a collection of dubious repute, one is obliged to reflect upon the standards that the Zoo Federation sets when granting membership. The situation is even worse in developing countries where little money is available for redevelopment and it is hard to see a way of incorporating collections into the overall scheme of the WZCS.

Even assuming that the WZCS's 1,000 core zoos are all of a high standard complete with scientific staff and research facilities, trained and dedicated keepers, accommodation that permits normal or natural behaviour, and a policy of co-operating fully with one another what might be the potential for conservation? Colin Tudge, author of *Last Animals at the Zoo* (Oxford University Press, 1992), argues that "if the world's zoos worked together in co-operative breeding programmes, then even without further expansion they could save around 2,000 species of endangered land vertebrates". This seems an extremely optimistic proposition from a man who must be aware of the failings and weaknesses of the zoo industry the man who, when a member of the council of London Zoo, had to persuade the zoo to devote more of its activities to conservation. Moreover, where are the facts to support such optimism?

Today approximately 16 species might be said to have been "saved" by captive breeding programmes, although a number of these can hardly be looked upon as resounding successes. Beyond that, about a further 20 species are being seriously considered for zoo conservation programmes. Given that the international conference at London Zoo was held 30 years ago, this is pretty slow progress, and a long way off Tudge's target of 2,000.

### Questions 16-22

Do the following statements agree with the views of the writer in Reading Passage 2? In boxes 16-22 write

- |           |  |
|-----------|--|
| YES       | if the statement agrees with the writer                      |
| NO        | if the statement contradicts the writer                      |
| NOT GIVEN | if it is impossible to say what the writer thinks about this |

- 16 London Zoo's advertisements are dishonest.  
17 Zoos made an insignificant contribution to conservation up until 30 years ago.  
18 The WZCS document is not known in Eastern Europe.  
19 Zoos in the WZCS select list were carefully inspected.  
20 No one knew how the animals were being treated at Robin Hill Adventure Park.  
21 Colin Tudge was dissatisfied with the treatment of animals at London Zoo.  
22 The number of successful zoo conservation programmes is unsatisfactory.

### Questions 23-25

Choose the appropriate letters A-D and write them in boxes 23-25 on your answer sheet.

23 What were the objectives of the WZCS document?

- A to improve the calibre of zoos world-wide
- B to identify zoos suitable for conservation practice
- C to provide funds for zoos in underdeveloped countries
- D to list the endangered species of the world

24 Why does the writer refer to Robin Hill Adventure Park?

- A to support the Isle of Wight local council
- B to criticise the 1981 Zoo Licensing Act
- C to illustrate a weakness in the WZCS document
- D to exemplify the standards in AAZPA zoos

25 What word best describes the writer's response to Colin Tudges' prediction on captive breeding programmes?

- A disbelieving
- B impartial
- C prejudiced
- D accepting

### Questions 26-28

The writer mentions a number of factors which lead him to doubt the value of the WZCS document.

Which THREE of the following factors are mentioned?

Write your answers (A-F) in boxes 26-28 on your answer sheet.

List of Factors

- A the number of unregistered zoos in the world
- B the lack of money in developing countries
- C the actions of the Isle of Wight local council
- D the failure of the WZCS to examine the standards of the "core zoos"
- E the unrealistic aim of the WZCS in view of the number of species "saved" to date
- F the policies of WZCS zoo managers

### ARCHITECTURE – Reaching for the Sky

Architecture is the art and science of designing buildings and structures. A building reflects the scientific and technological achievements of the age as well as the ideas and aspirations of the designer and client. The appearance of individual buildings, however, is often controversial.

The use of an architectural style cannot be said to start or finish on a specific date. Neither is it possible to say exactly what characterises a particular movement. But the origins of what is now generally known as modern architecture can be traced back to the social and technological changes of the 18th and 19th centuries.

Instead of using timber, stone and traditional building techniques, architects began to explore ways of creating buildings by using the latest technology and materials such as steel, glass and concrete strengthened steel bars, known as reinforced concrete. Technological advances also helped bring about the decline of rural industries and an increase in urban populations as people moved to the towns to work in the new factories. Such rapid and uncontrolled growth helped to turn parts of cities into slums.

By the 1920s architects throughout Europe were reacting against the conditions created by industrialisation. A new style of architecture emerged to reflect more idealistic notions for the future. It was made possible by new materials and construction techniques and was known as Modernism.

By the 1930s many buildings emerging from this movement were designed in the International Style. This was largely characterised by the bold use of new materials and simple, geometric forms, often with white walls supported by stilt-like pillars. These were stripped of unnecessary decoration that would detract from their primary purpose — to be used or lived in.

Walter Gropius, Charles Jeanneret (better known as Le Corbusier) and Ludwig Mies van der Rohe were among the most influential of the many architects who contributed to the development of Modernism in the first half of the century. But the economic depression of the 1930s and the second world war (1939-45) prevented their ideas from being widely realised until the economic conditions improved and war-torn cities had to be rebuilt. By the 1950s, the International Style had developed into a universal approach to building, which standardised the appearance of new buildings in cities across the world.

Unfortunately, this Modernist interest in geometric simplicity and function became exploited for profit. The rediscovery of quick-and-easy-to-handle reinforced concrete and an improved ability to prefabricate building sections meant that builders could meet the budgets of commissioning authorities and handle a renewed demand for development quickly and cheaply. But this led to many badly designed buildings, which discredited the original aims of Modernism.

Influenced by Le Corbusier's ideas on town planning, every large British city built multi-storey housing estates in the 1960s. Mass-produced, low-cost high-rises seemed to offer a solution to the problem of housing a growing inner-city population. But far from meeting human needs, the new estates often proved to be windswept deserts lacking essential social facilities and services. Many of these buildings were poorly designed and constructed and have since been demolished.

By the 1970s, a new respect for the place of buildings within the existing townscape arose. Preserving historic buildings or keeping only their facades (or fronts) grew common.

Architects also began to make more use of building styles and materials that were traditional to the area. The architectural style usually referred to as High Tech was also emerging. It celebrated scientific and engineering achievements by openly parading the sophisticated techniques used in construction. Such buildings are commonly made of metal and glass; examples are Stansted airport and the Lloyd's building in London.

Disillusionment at the failure of many of the poor imitations of Modernist architecture led to interest in various styles and ideas from the past and present. By the 1980s the coexistence of different styles of architecture in the same building became known as Post Modern. Other architects looked back to the classical tradition. The trend in architecture now favours smaller scale building design that reflects a growing public awareness of environmental issues such as energy efficiency. Like the Modernists, people today recognise that a well designed environment improves the quality of life but is not necessarily achieved by adopting one well defined style of architecture.

Twentieth century architecture will mainly be remembered for its tall buildings. They have been made possible by the development of light steel frames and safe passenger lifts. They originated in the US over a century ago to help meet the demand for more economical use of land. As construction techniques improved, the skyscraper became a reality.

Questions 29-35

Complete the table below using information from Reading Passage 3. Write NO MORE THAN THREE WORDS for each answer. Write your answers in boxes 29-35 on your answer sheet.

PERIOD	STYLE OF PERIOD	BUILDING MATERIALS	CHARACTERISTICS
Before 18th century	<i>Example traditional</i>	(29).....	
1920s	<u>introduction of</u> (30).....	steel, glass and concrete	exploration of latest technology
1930s - 1950s	(31).....		geometric forms
1960s	decline of Modernism	pre-fabricated sections	(32).....
1970s	end of Modernist era	traditional materials	(33)..... of historic buildings
1970s	beginning of (34)..... era	metal and glass	sophisticated techniques paraded
1980s	Post-Modernism		(35).....

Questions 36-40

Reading Passage 3 describes a number of cause and effect relationships. Match each Cause (36-40) in List

A, with its Effect (A-H) in List B.

Write your answers (A-H) in boxes 36 40 on your answer sheet.

NB There are more effects in List B than you will need, so you will not use all of them. You may use any effect more than once if you wish.

List A CAUSES	List B EFFECTS
36 A rapid movement of people from rural areas to cities is triggered by technological advance	<b>A</b> The quality of life is improved
37 Buildings become simple and functional.	<b>B</b> Architecture reflects the age
38 An economic depression and the second world war hit Europe	<b>C</b> A number of these have been knocked down
39 <del>Multi-storey</del> housing estates are built according to contemporary ideas on town planning.	<b>D</b> Light steel frames and lifts are developed
40 <del>Less</del> land must be used for building.	<b>E</b> Historical buildings are preserved
	<b>F</b> All decoration is removed
	<b>G</b> Parts of cities become slums
	<b>H</b> Modernist ideas cannot be put into practice until the second half of the 20th century