Reading 32 - A spark, a flint: How fire leapt to life

*You should spend about 20 minutes on **Questions 1-15** which are based on Reading*

Passage 32 below

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, the 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 peoples 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.

FeS_2, fool's gold

Percussion methods of fire-lighting date back to Paleolithic times, when some Stone Age toolmakers 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 revolutionized 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 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-after-glow 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 at the bottom of the page 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

Primitive Societies saw fire as a ……(Example)…..… gift. Answer: heavenly

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	realising
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 32. 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.

Example	***Answer***
could be lit after soaking in water	**H**

NOTES	**Types of Matches**
9 made using a less poisonous type of phosphorus	
10 identical to a previous type of match	A the Ethereal Match
11 caused a deadly illness	B the Instantaneous Light box
12 first to look like modern matches	C Congreves
13 first matches used for advertising	D Lucifers
14 relied on an airtight glass container	E the first strike-anywhere match
15 made with the help of an army design	F Lundstrom's safety match
	G book matches
	H waterproof matches

Answer:

1 preserve
2 unaware
3 chance
4 friction
5 rotating
6 percussion
7 Eskimos
8 despite
9 F
10 D
11 E
12 C
13 G
14 A
15 C

Vocabulary list

Write down the meanings of the following words.

primitive	peasants	wrapping	cord	briskly	palms	Paleolithic	concentrate

match	flint						

Grammatical notes:

1.
2
3
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火花，火石：火如何激起生機
[控制火災是人類邁向提高生命技術的第一步，也許是最重要的步驟。]

對於早期的人來說，火是一種以閃電，森林火焰或燃燒的熔岩形式隨機傳播的神聖禮物。由於無法為自己製造火焰，最早的人們可能通過保持緩慢燃燒的木柴或將木炭放在鍋中來儲存火種。
人們如何以及在哪裡學會如何產生火焰是未知的。這可能是一個二次發明，在用木頭或石頭進行工具製作時偶然發生。原始社會的研究表明，最早的製造方法是通過摩擦。歐洲農民會在圓孔中插入一把木鑽，然後輕輕地將它們在手掌間旋轉。這個過程可以通過在鑽頭周圍纏繞繩索並在每端拉動來加速。
古希臘人用鏡片或凹面鏡來聚焦太陽光線，墨西哥阿茲台克人和中國人也使用燃燒的眼鏡。

FeS2，傻瓜的黃金打火照明方法可以追溯到舊石器時代，當時一些石器時代的工具製造者發現碎石燧石產生火花。在約 5000 年前發現鐵後，該技術變得更加高效。在北極北美，愛斯基摩人通過石英撞擊含鐵硫化合物鐵黃鐵礦而產生了一種緩慢燃燒的火花。中國人用竹子打瓷器點燃了火。在歐洲，鋼鐵，火石和火絨的組合仍然是火災照明的主要方法，直到 19 世紀中期。

消防照明由於磷的發現而發生了革命性的變化，1669 年一位德國煉金術士試圖將銀轉化為黃金。該元素的可燃性令人印象深刻，幾位 17 世紀的化學家用它製造消防照明設備，但結果是危險的易燃品。由於磷的成本相當於每盎司幾百磅，所以第一場比賽是昂貴的。
1781 年之後，一群法國化學家提出了磷光蠟燭或 Ethereal Match，這是一個密封的玻璃管，裡面裝有一束帶有磷的紙捻。當管子破裂時，空氣沖入，導致磷自燃。在美國很流行的一種更危險的設備是瞬間燈箱 - 一種裝滿硫酸的瓶子，用化學製品處理的夾板浸入其中。
類似於今天使用的第一批比賽是 1827 年由英國藥劑師約翰沃克製作的，他從一名名叫 Congreve 的軍事火箭製造商那裡借鑒了這個配方。花費一個盒子，Congreves 用硫磺塗上夾板，並用氯酸鉀打孔。為了點亮它們，用戶通過折疊的玻璃紙快速地將它們抽出。
沃克從來沒有為他的發明申請過專利，三年後，他被一位塞繆爾瓊斯複製，他將他的產品作為路西弗斯銷售。與此同時，一位法國化學學生 Charles Sauria 用 Walker 配方中的白磷取代氯酸鉀，製作了第一個“隨時隨地”的比賽。然而，由於白磷是一種致命的毒藥，從 1845 年暴露於其煙霧中的製造者死於壞死，這種疾病消耗了下頜骨。直到 1906 年，該物質才被最終禁止。
那是在瑞典化學家 Pasch 發現了無毒紅色或無定形磷後 62 年，這是 1885 年 Pasch 的同胞 J E Lundstrom 商業開發的一種發展。Lundstrom 的安全火柴是安全的，因為紅磷是無毒的;它被塗在擊球表面而不是比賽頭，其中包含具有 182 攝氏度的較高點燃溫度的氯酸鉀。
在匹配技術和安全標準方面，美國落後於歐洲。直到 1900 年，鑽石比賽公司才購買了法國的安全火柴專利 - 但這種配方在美國普遍存在的不同氣候條件下無法正常工作，並且在科學家最終將法國專利改編為美國之前還有 11 年之久。 。
然而，美國人在比賽技術和市場營銷方面可以獲得幾個“第一”。 1892 年，鑽石比賽公司率先開展了書籍比賽。直到 1896 年之後，這個創新才剛剛開始，當時一家釀酒廠有了一個新穎的想法，就是在火柴盒上宣傳自己的產品。今天，書籍搭配是美國使用最廣泛的類型，其中 90％由酒店，餐館和其他人免費發放。
其他美國的創新包括一種防止發光的解決方案，以防止火柴在被吹滅後發生陰燃;以及在水中 8 小時後點亮的防水配件。