

## READING PASSAGE 1

You should spend about 20 minutes on **Questions 1-16**, which are based on Reading Passage 1 below.

### The inventor of the periodic table – Dmitri Ivanovich Mendeleev

*Mendeleev's wish – to find a better way of organizing chemistry – led to the creation of his periodic table, one of the most iconic symbols in science.*

1																		18
<i>H</i>	2																	<i>He</i>
3	4																	
<i>Li</i>	<i>Be</i>																	
11	12																	
<i>Na</i>	<i>Mg</i>	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
<i>K</i>	<i>Ca</i>	<i>Sc</i>	<i>Ti</i>	<i>V</i>	<i>Cr</i>	<i>Mn</i>	<i>Fe</i>	<i>Co</i>	<i>Ni</i>	<i>Cu</i>	<i>Ga</i>	<i>Ge</i>	<i>As</i>	<i>Se</i>	<i>Br</i>	<i>Kr</i>		
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
<i>Rb</i>	<i>Sr</i>	<i>Y</i>	<i>Zr</i>	<i>Nb</i>	<i>Mo</i>	<i>Tc</i>	<i>Ru</i>	<i>Rh</i>	<i>Pd</i>	<i>Ag</i>	<i>Cd</i>	<i>In</i>	<i>Sn</i>	<i>Sb</i>	<i>Te</i>	<i>I</i>	<i>Xe</i>	
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	
<i>Cs</i>	<i>Ba</i>	71	<i>Hf</i>	<i>Ta</i>	<i>W</i>	<i>Re</i>	<i>Os</i>	<i>Ir</i>	<i>Pt</i>	<i>Au</i>	<i>Hg</i>	<i>Tl</i>	<i>Pb</i>	<i>Bi</i>	<i>Po</i>	<i>At</i>	<i>Rn</i>	
87	88	89-	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	
<i>Fr</i>	<i>Ra</i>	103	<i>Rf</i>	<i>Db</i>	<i>Sg</i>	<i>Bh</i>	<i>Hs</i>	<i>Mt</i>	<i>Ds</i>	<i>Uub</i>	<i>Uut</i>	<i>Uuo</i>	<i>Uup</i>	<i>Uuh</i>	<i>Uus</i>	<i>Uuo</i>		
Lanthanide series		57	58	59	60	61	62	63	64	65	66	67	68	69	70	71		
<i>La</i>		<i>Ce</i>	<i>Pr</i>	<i>Nd</i>	<i>Pm</i>	<i>Sm</i>	<i>Eu</i>	<i>Gd</i>	<i>Tb</i>	<i>Dy</i>	<i>Ho</i>	<i>Er</i>	<i>Tm</i>	<i>Yb</i>	<i>Lu</i>			
Actinide series		89	90	91	92	93	94	95	96	97	98	99	100	101	102	103		
<i>Ac</i>		<i>Th</i>	<i>Pa</i>	<i>U</i>	<i>Np</i>	<i>Pu</i>	<i>Am</i>	<i>Cm</i>	<i>Bk</i>	<i>Cf</i>	<i>Es</i>	<i>Fm</i>	<i>Md</i>	<i>No</i>	<i>Lr</i>			

Dmitri Ivanovich Mendeleev was born on February 8, 1834 in Verkhnie Aremzyani, in the Russian province of Siberia. His father, a graduate of Saint Petersburg's Main Pedagogical Institute, died when Mendeleev was just 13. At age 16, Mendeleev relocated to Saint Petersburg, which was then Russia's capital city. He won a place at his father's old college, where he initially trained as a teacher, in part because the director of the Institute had known his father. However, he went on to achieve worldwide fame as a chemist.

By the time he was 20, Mendeleev was already having research papers published. However, he was troubled with various health issues and was often so ill with tuberculosis that he was forced to work from his bed. His uncontrollable temper made him unpopular with some of the staff and his classmates, but he still graduated as the top student in his year. In 1855, he got a job in Simferopol, Crimea, but soon returned to Saint Petersburg, where he worked towards a Master's degree in chemistry. He gained his Master's in 1856.

A few years later, he was given the opportunity to go to western Europe to pursue chemical enquiry. He spent most of 1859 and 1860 in Heidelberg, Germany. Here he had the good fortune to work briefly with renowned German chemist Robert Bunsen at Heidelberg University, before setting up a laboratory in his own apartment.

In 1860, Mendeleev attended the first ever international chemistry conference, held in Karlsruhe, Germany. Much of the event was spent discussing the need to standardize chemistry, and this played a key role in Mendeleev's eventual development of his periodic table of the elements.

By the time he returned to Saint Petersburg in 1861, this time to work at the Technical Institute, Mendeleev had become even more passionate about chemistry. He was

concerned that Russia was trailing behind Germany in this field. He thought improved Russian-language chemistry textbooks were necessary, and was determined to do something about it. In just 61 days, the 27-year-old chemist wrote his 500-page *Organic Chemistry*, which put him at the forefront of Russian chemical education.

Mendeleev was a charismatic lecturer and held a number of academic positions until, in 1867, aged just 33, he was awarded the Chair of General Chemistry at the University of Saint Petersburg. In this prestigious position he continued pushing to improve chemistry in Russia, publishing *The Principles of Chemistry* in 1869. The popularity of this work in Russia and elsewhere led to the publication of translations three languages: English, French and German.

At this time, chemistry was a patchwork of observations and discoveries. Mendeleev was certain that better, more fundamental principles could be found. This was his mindset when, in 1869, he began writing a second volume of his book *The Principles of Chemistry*. At the heart of chemistry were hydrogen, oxygen and all its other elements. What, wondered Mendeleev, could they reveal if he could find some way of organizing them logically?

He wrote the names of the 65 known-elements on cards - one element on each card - and then wrote the fundamental properties of each element, including atomic weight, on its card. He saw that atomic weight was important in some way - the behavior of the elements seemed to repeat as their atomic weights increased - but he could not see the pattern. Convinced that he was close to making a significant discovery, Mendeleev moved the cards about for hours until finally he fell asleep at his desk. When he awoke, he found that his subconscious mind had done his work for him. He now knew the pattern the elements fell into. He later wrote, 'In a dream I saw a table where all the elements fell into place as required. Awakening, I immediately wrote it down on a piece of paper.'

Two weeks later, he published a paper entitled *The Relation between the Properties and Atomic Weights of the Elements*. The-periodic table had been released to the scientific world. As with many scientific discoveries, there is a time when a concept becomes ripe for discovery, and this was the case in 1869 with the periodic table.

Lothar Meyer, for example, had proposed a rough periodic table in 1864 and by 1868 had devised one that was very similar to Mendeleev's, but he did not publish it until 1870.

Mendeleev was successful because he not only showed how the elements could be organized, but he used his periodic table to predict the existence of eight new elements and also to propose that some of the elements, whose behavior did not agree with what he predicted, must have had their atomic weights measured incorrectly. It turned out that chemists had measured some atomic weights incorrectly. Mendeleev was right. Scientists everywhere started to pay attention to his periodic table. And on the discovery of new elements, as per his prediction, Mendeleev's fame and scientific reputation were further enhanced.



In 1905, the British Royal Society gave him its highest honor, the Copley Medal, for his achievements, and in the same year he was elected to the Royal Swedish Academy of Sciences. Element 101 is named Mendelevium in his honor.

Dmitri Mendeleev died in Saint Petersburg, on February 2, 1907.

### Questions 1 – 8

Complete the notes below.

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

Write your answers in boxes 1-8 on your answer sheet.

Dmitri Ivanovich Mendeleev

#### Mendeleev's early life:

- he studied to become a 1 ..... in St Petersburg
- he often had to work in bed when he was sufferingg from 2 .....

#### Mendeleev's career:

- went to a 3 ..... in 1860, which inspired his work on the periodic table
- 1861 – he wrote Organic Chemistry, having identified a need for better 4 ..... in Russian
- several 5 ..... of The Principles of Chemistry were published

#### Mendeleev's work on the periodic table:

- he used cards to make a note of the atomic weight and other 6 ..... of the elements
- when asleep, he subconciously discovered a 7 ..... which organised the elements in a table
- 1869 – Mendeleev's periodic table was made public
- Mendeleev's reputation grew after he made 8 ..... about further elements

### Questions 9 – 16

Do the following statements agree with the information given in Reading Passage 1?

In boxes 9-16 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

**9** Dmitri Mendeleev was the first member of his family to receive a college education.

**10** While he was studying in Saint Petersburg, Mendeleev often failed to control his anger.

**11** During his time at Heidelberg University, Mendeleev published a paper with Robert Bunsen.

**12** Mendeleev worried that Germany was more succesful than Russia in the field of chemistry.

**13** It took Mendeleev less than a year to write the second volume of his book *The Principles of Chemistry*.

**14** Mendeleev was the first scientist to suggest the organisation of the element in a table.

**15** Mendeleev's paper on the periodic table received a positive reception from the scientific community.

**16** In his lifetime, Mendeleev failed to receive any awards for his work in chemistry.