



Sixth Form Entrance 2018

CHEMISTRY

1 hour

Name (Capital Letters):

Present School:

Answer ALL the questions

TOTAL: 60 marks

Answers to Section A should be answered on the question paper.

Answers to Section B should be written on the blank pages at the end of the question paper.

A copy of the Periodic Table is included with the question paper (back page).

Use of a calculator is permitted.

If you know the name of the examination board and the title of the chemistry course you are currently studying e.g. AQA Chemistry, Edexcel, OCR Gateway or 21st Century Science, IGCSE write it below. Indicate if you are doing Triple Science (i.e. you will get separate grades in Biology, Chemistry and Physics) or Double Science.

Board _____ Course _____ Triple/Double _____

SECTION A

Q1 Use the Periodic Table to help you with this question.
Identify the particle, remember to include the relative atomic mass number in your response

- (i) An atom with 10 protons and the same number of neutrons than that of an atom of ^{39}K

- (ii) An ion with one more proton and two more neutrons as an atom of ^{20}Ne but the same number of electrons

- (iii) An ion with one more proton, two more neutrons, but the same number of electrons as an ion of $^{85}\text{Rb}^+$

- (iv) An ion with one less proton, one less neutron and the same number of electrons as an atom of ^{129}Xe

[TOTAL = 7]

- Q2** (a) You are given the formulae of the following ions. Write the chemical formula of the following substances. The first one is shown as an example.

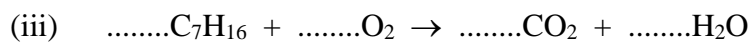
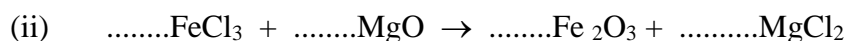
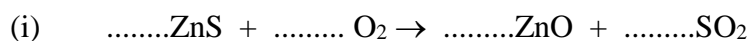
Ion	Formula	Ion	Formula
Ammonium	NH_4^+	Phosphate	PO_4^{3-}
Magnesium	Mg^{2+}	Nitride	N^{3-}
Lithium	Li^+	Hydroxide	OH^-
Potassium	K^+	Hydrogencarbonate	HCO_3^-
Lead(II)	Pb^{2+}	Carbonate	CO_3^{2-}
Iron(III)	Fe^{3+}	Sulfate	SO_4^{2-}
Barium	Ba^{2+}	Nitrate	NO_3^-

Example: Barium Iodide BaI_2

- (i) Barium Chloride.....
- (ii) Magnesium Nitride.....
- (iii) Iron (III) Sulfate.....
- (iv) Lithium Carbonate.....
- (v) Ammonium Phosphate.....

[5]

- (b) Put numbers in front of the formulae as necessary to balance the equations below:



[3]

[TOTAL = 8]

Q3 The following table gives some information about several substances.

Substance	Melting point / °C	Boiling point / °C	Electrical conductivity when solid	Electrical conductivity when molten	Solubility in water
A	910	1555	good	good	insoluble
B	-105	10	poor	poor	soluble
C	546	1234	poor	good	soluble
D	-154	-55	poor	poor	insoluble
E	1955	3546	poor	poor	insoluble

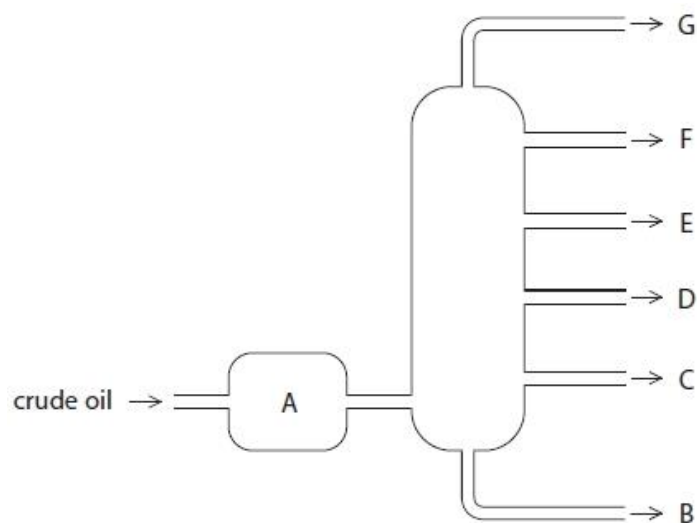
For each of the substances, A to E, decided the type of bonding **and** structure present. Circle the correct answers below.

- (a) **A:** Bonding – Covalent / Ionic / Metallic
Structure – Giant / Simple Molecular
- (b) **B:** Bonding – Covalent / Ionic / Metallic
Structure – Giant / Simple Molecular
- (c) **C:** Bonding – Covalent / Ionic / Metallic
Structure – Giant / Simple Molecular
- (d) **D:** Bonding – Covalent / Ionic / Metallic
Structure – Giant / Simple Molecular
- (e) **E:** Bonding – Covalent / Ionic / Metallic
Structure – Giant / Simple Molecular

[TOTAL = 5]

Q4 Crude oil is an important source of organic compounds.

(a) The diagram shows how crude oil is separated into fractions in the oil industry.



(i) What happens to the crude oil in A?

(1)

.....

.....

.....

(ii) Most of the compounds in crude oil are hydrocarbons.

What is meant by the term **hydrocarbons**?

(2)

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(iii) Compare the hydrocarbons in fractions D and F in terms of

- boiling point
- size of molecules
- viscosity

(3)

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(b) Some of the fractions are catalytically cracked. The general equation for some reactions in this process is



(i) State two conditions used in catalytic cracking.

(2)

1

.....

2

.....

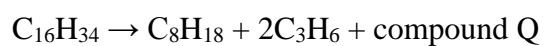
(ii) How does the bonding in an alkene molecule differ from the bonding in an alkane molecule?

(1)

.....

.....

(iii) The chemical equation for one cracking reaction is



Deduce the molecular formula of Q.

(1)

.....

(c) The compound with molecular formula C_3H_6 can be used to make a polymer.

(i) Give the name of the compound C_3H_6

(1)

.....

(ii) Complete the table of information about this compound.

(3)

Type of formula	Formula
molecular	C_3H_6
	C_nH_{2n}
	CH_2
displayed	

(iii) Complete this structure to show the part of the polymer formed from two molecules of C_3H_6

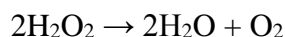
(2)



[TOTAL = 16]

Q5 Hydrogen peroxide solution decomposes very slowly at room temperature.

The equation for this reaction is



Very few bubbles can be seen in the solution because of the slow decomposition.

The rate of this reaction is greatly increased by adding a catalyst.

(a) A student added a solid to some hydrogen peroxide solution to see if the solid acted as a catalyst.

He noticed that a lot of bubbles formed, and that the solid was still present at the end of the reaction.

Outline a method to show that the solid acted as a catalyst and not as a reactant.

(2)

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(b) The student investigated the effect that changing the concentration of the hydrogen peroxide solution has on the rate of the reaction.

He used solid manganese(IV) oxide as the catalyst in each experiment.

This is the method he used.

- pour some hydrogen peroxide solution into a conical flask on a top-pan balance
- add the catalyst and place some cotton wool loosely in the neck of the flask
- record the balance reading and start a timer
- record the balance reading every minute until the mass no longer changes
- repeat the experiment several times using different concentrations of hydrogen peroxide solution(i)

State one property of each substance that the student should keep the same in each experiment.

(2)

hydrogen peroxide solution

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.....

manganese(IV) oxide

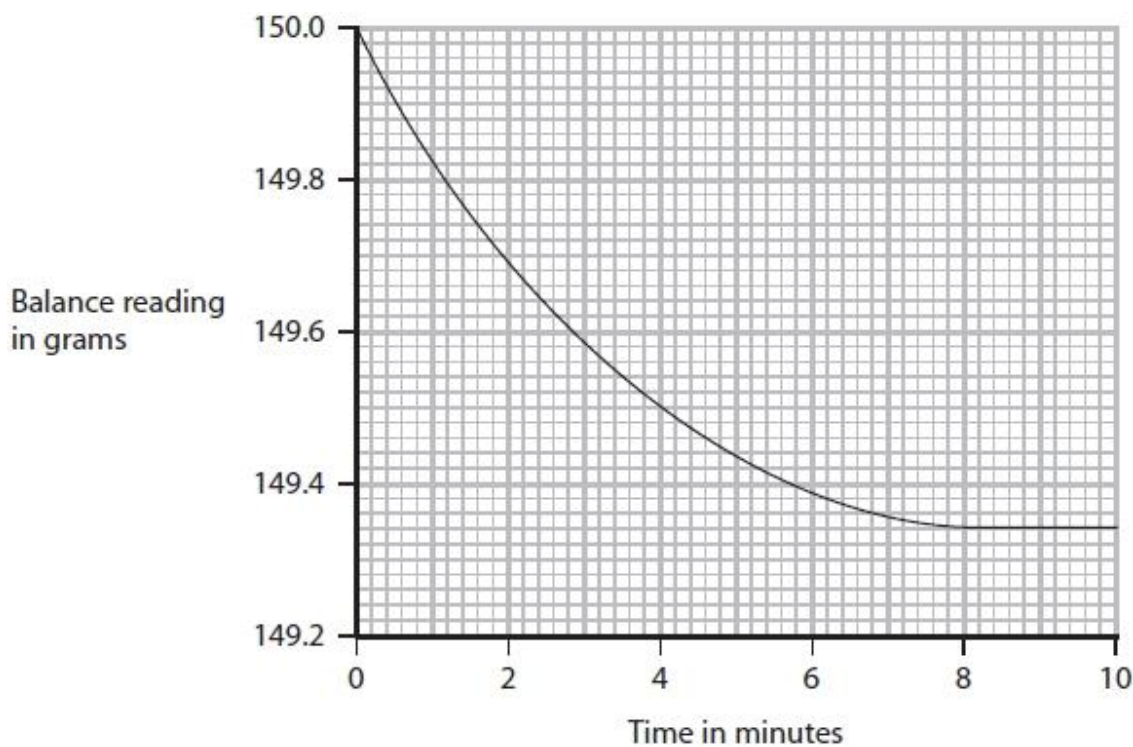
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(ii) What is the purpose of the cotton wool?

(1)

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.....

(c) The graph shows the results of one of the student's experiments.



(i) Why does the balance reading decrease during the experiment?

(1)

.....
.....

(ii) What does the slope of the curve indicate about the reaction?

(1)

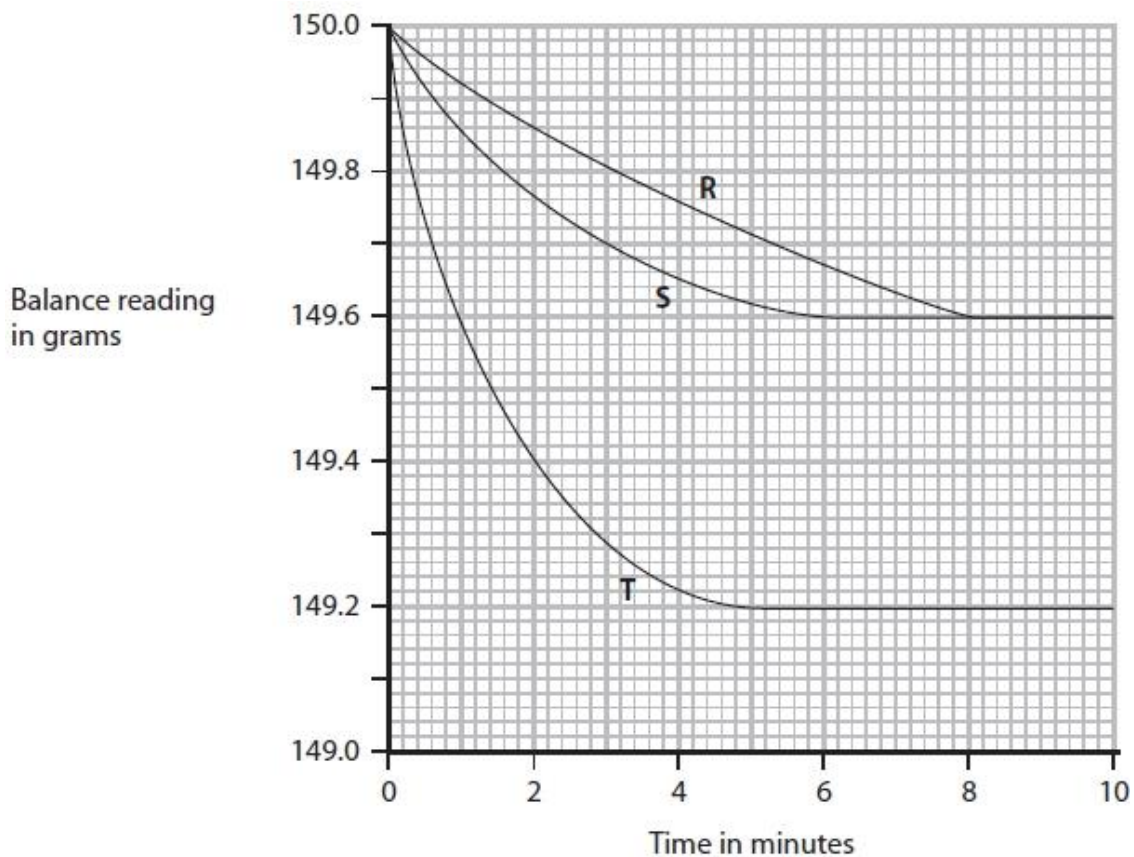
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(iii) How long does the reaction take to complete?

(1)

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.....

(d) The results of some of the student's other experiments are shown on this graph.



(i) Which one of the experiments, R, S or T, was the fastest?
State how you deduced your answer.

(1)

.....
.....
.....

- (ii) The concentration of the hydrogen peroxide solution in experiment S was 0.40 mol/dm^3 .
Use the graph to deduce the concentration of the hydrogen peroxide solution in experiment T.

State how you deduced your answer.

(2)

concentration = mol/dm^3

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- (e) Another student repeated the investigation.

She recorded the time for the total mass of the beaker and contents to decrease by 0.50 g in each experiment. She then converted the times to relative rates of reaction.

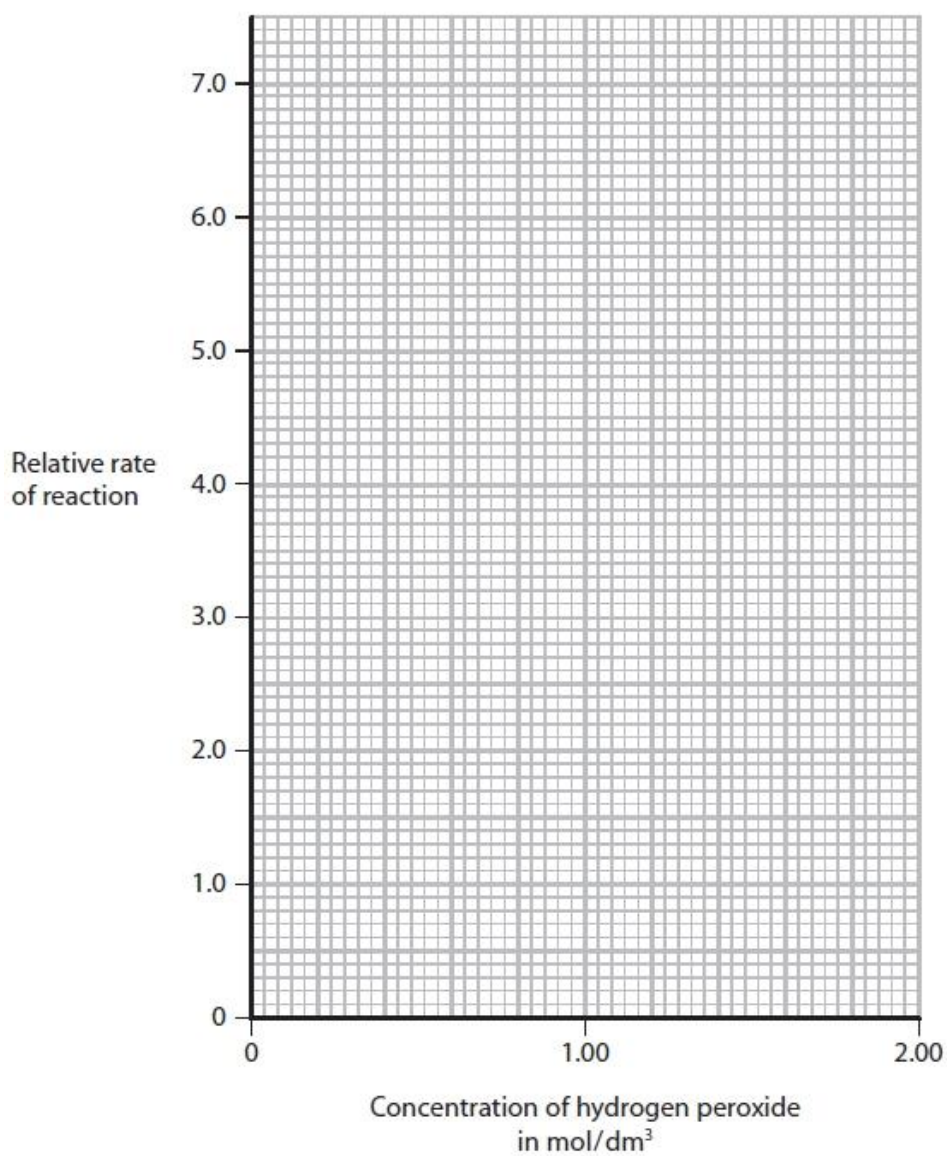
The table shows the concentrations she used and the relative rates of reaction she calculated.

Relative rate of reaction	1.5	2.2	3.0	4.4	5.1	6.0	7.4
Concentration in mol/dm^3	0.40	0.60	0.80	1.20	1.40	1.60	2.00

Plot a graph of these results on the grid.

Draw a straight line of best fit through the points.

(3)



(f) Explain, in terms of particles, why the rate of a reaction increases as the concentration of a reactant increases.

(2)

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[TOTAL = 16]

SECTION B

Write your answers to this section on the blank pages which follow.

Write notes on **TWO** of the following [4 marks each]. Use diagrams and chemical equations where relevant.

- (a) The bonding and structure of graphite and diamond
- (b) The manufacture of iron from its ore
- (c) The industrial electrolysis of brine
- (d) The reactivity of alkenes
- (e) The concept of the mole and how it is used in Chemistry

SECTION B ANSWER

SECTION B ANSWER (continued)

SECTION B ANSWER (continued)

THE PERIODIC TABLE

Period 1 2 3 4 5 6 7 0 Group

1

1	H Hydrogen 1
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2

2	He Helium 4
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3

3	Li Lithium 7	Na Sodium 23	K Potassium 39
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4

4	Be Beryllium 9	Mg Magnesium 24	Ca Calcium 40	Sc Scandium 45
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5

5	B Boron 11	Al Aluminium 27	Ga Gallium 70	In Indium 115	Tl Thallium 204
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6

6	C Carbon 12	Si Silicon 28	Ge Germanium 73	Sn Tin 119	Pb Lead 207
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7

7	N Nitrogen 14	P Phosphorus 31	As Arsenic 75	Sb Antimony 122	Bi Bismuth 209
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8

8	O Oxygen 16	S Sulphur 32	Se Selenium 79	Te Tellurium 128	Po Polonium (210)
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9

9	F Fluorine 19	Cl Chlorine 35.5	Br Bromine 80	I Iodine 127	At Astatine (210)
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10

10	Ne Neon 20	Ar Argon 40	Kr Krypton 84	Xe Xenon 131	Rn Radon (222)
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11

11	B Boron 11	Al Aluminium 27	Ga Gallium 70	In Indium 115	Tl Thallium 204
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12

12	C Carbon 12	Si Silicon 28	Ge Germanium 73	Sn Tin 119	Pb Lead 207
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13

13	N Nitrogen 14	P Phosphorus 31	As Arsenic 75	Sb Antimony 122	Bi Bismuth 209
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14

14	O Oxygen 16	S Sulphur 32	Se Selenium 79	Te Tellurium 128	Po Polonium (210)
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15

15	F Fluorine 19	Cl Chlorine 35.5	Br Bromine 80	I Iodine 127	At Astatine (210)
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16

16	Ne Neon 20	Ar Argon 40	Kr Krypton 84	Xe Xenon 131	Rn Radon (222)
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17

17	B Boron 11	Al Aluminium 27	Ga Gallium 70	In Indium 115	Tl Thallium 204
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18

18	C Carbon 12	Si Silicon 28	Ge Germanium 73	Sn Tin 119	Pb Lead 207
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19

19	N Nitrogen 14	P Phosphorus 31	As Arsenic 75	Sb Antimony 122	Bi Bismuth 209
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20

20	O Oxygen 16	S Sulphur 32	Se Selenium 79	Te Tellurium 128	Po Polonium (210)
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21

21	F Fluorine 19	Cl Chlorine 35.5	Br Bromine 80	I Iodine 127	At Astatine (210)
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22

22	Ne Neon 20	Ar Argon 40	Kr Krypton 84	Xe Xenon 131	Rn Radon (222)
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23

23	B Boron 11	Al Aluminium 27	Ga Gallium 70	In Indium 115	Tl Thallium 204
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24

24	C Carbon 12	Si Silicon 28	Ge Germanium 73	Sn Tin 119	Pb Lead 207
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25

25	N Nitrogen 14	P Phosphorus 31	As Arsenic 75	Sb Antimony 122	Bi Bismuth 209
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26

26	O Oxygen 16	S Sulphur 32	Se Selenium 79	Te Tellurium 128	Po Polonium (210)
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27

27	F Fluorine 19	Cl Chlorine 35.5	Br Bromine 80	I Iodine 127	At Astatine (210)
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28

28	Ne Neon 20	Ar Argon 40	Kr Krypton 84	Xe Xenon 131	Rn Radon (222)
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29

29	B Boron 11	Al Aluminium 27	Ga Gallium 70	In Indium 115	Tl Thallium 204
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30

30	C Carbon 12	Si Silicon 28	Ge Germanium 73	Sn Tin 119	Pb Lead 207
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31

31	N Nitrogen 14	P Phosphorus 31	As Arsenic 75	Sb Antimony 122	Bi Bismuth 209
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32

32	O Oxygen 16	S Sulphur 32	Se Selenium 79	Te Tellurium 128	Po Polonium (210)
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33

33	F Fluorine 19	Cl Chlorine 35.5	Br Bromine 80	I Iodine 127	At Astatine (210)
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34

34	Ne Neon 20	Ar Argon 40	Kr Krypton 84	Xe Xenon 131	Rn Radon (222)
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35

35	B Boron 11	Al Aluminium 27	Ga Gallium 70	In Indium 115	Tl Thallium 204
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36

36	C Carbon 12	Si Silicon 28	Ge Germanium 73	Sn Tin 119	Pb Lead 207
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37

37	N Nitrogen 14	P Phosphorus 31	As Arsenic 75	Sb Antimony 122	Bi Bismuth 209
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38

38	O Oxygen 16	S Sulphur 32	Se Selenium 79	Te Tellurium 128	Po Polonium (210)
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39

39	F Fluorine 19	Cl Chlorine 35.5	Br Bromine 80	I Iodine 127	At Astatine (210)
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40

40	Ne Neon 20	Ar Argon 40	Kr Krypton 84	Xe Xenon 131	Rn Radon (222)
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41

41	B Boron 11	Al Aluminium 27	Ga Gallium 70	In Indium 115	Tl Thallium 204
----	-------------------------	------------------------------	----------------------------	----------------------------	------------------------------

42

42	C Carbon 12	Si Silicon 28	Ge Germanium 73	Sn Tin 119	Pb Lead 207
----	--------------------------	----------------------------	------------------------------	-------------------------	--------------------------

43

43	N Nitrogen 14	P Phosphorus 31	As Arsenic 75	Sb Antimony 122	Bi Bismuth 209
----	----------------------------	------------------------------	----------------------------	------------------------------	-----------------------------

44

44	O Oxygen 16	S Sulphur 32	Se Selenium 79	Te Tellurium 128	Po Polonium (210)
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45

45	F Fluorine 19	Cl Chlorine 35.5	Br Bromine 80	I Iodine 127	At Astatine (210)
----	----------------------------	-------------------------------	----------------------------	---------------------------	--------------------------------

46

46	Ne Neon 20	Ar Argon 40	Kr Krypton 84	Xe Xenon 131	Rn Radon (222)
----	-------------------------	--------------------------	----------------------------	---------------------------	-----------------------------

47

47	B Boron 11	Al Aluminium 27	Ga Gallium 70	In Indium 115	Tl Thallium 204
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48

48	C Carbon 12	Si Silicon 28	Ge Germanium 73	Sn Tin 119	Pb Lead 207
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49

49	N Nitrogen 14	P Phosphorus 31	As Arsenic 75	Sb Antimony 122	Bi Bismuth 209
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50

50	O Oxygen 16	S Sulphur 32	Se Selenium 79	Te Tellurium 128	Po Polonium (210)
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51

51	F Fluorine 19	Cl Chlorine 35.5	Br Bromine 80	I Iodine 127	At Astatine (210)
----	----------------------------	-------------------------------	----------------------------	---------------------------	--------------------------------

52

52	Ne Neon 20	Ar Argon 40	Kr Krypton 84	Xe Xenon 131	Rn Radon (222)
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53

53	B Boron 11	Al Aluminium 27	Ga Gallium 70	In Indium 115	Tl Thallium 204
----	-------------------------	------------------------------	----------------------------	----------------------------	------------------------------

54

54	C Carbon 12	Si Silicon 28	Ge Germanium 73	Sn Tin 119	Pb Lead 207
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55

55	N Nitrogen 14	P Phosphorus 31	As Arsenic 75	Sb Antimony 122	Bi Bismuth 209
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56

56	O Oxygen 16	S Sulphur 32	Se Selenium 79	Te Tellurium 128	Po Polonium (210)
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57

57	F Fluorine 19	Cl Chlorine 35.5	Br Bromine 80	I Iodine 127	At Astatine (210)
----	----------------------------	-------------------------------	----------------------------	---------------------------	--------------------------------

58

58	Ne Neon 20	Ar Argon 40	Kr Krypton 84	Xe Xenon 131	Rn Radon (222)
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59

59
