Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/21**

Paper 2 Multiple Choice (Extended) **October/November 2018**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

* 4 2 0 7 0 3 0 0 7 6 *

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 16.
Electronic calculators may be used.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **15** printed pages and **1** blank page.

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1 When smoke particles are observed with a microscope they are seen to move around randomly. This is called Brownian motion.

What causes Brownian motion?

A diffusion of the smoke particles

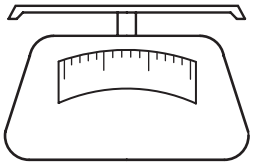
B molecules in the air hitting the smoke particles

C sublimation of the smoke particles

D the smoke particles hitting the walls of the container

2 The diagrams show four pieces of laboratory equipment.

balance



pipette



stop-clock



thermometer

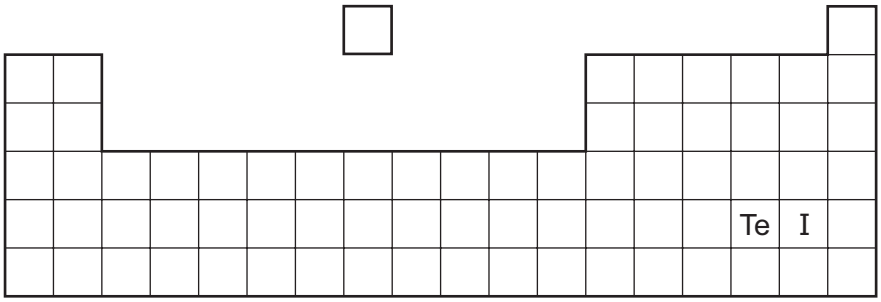


Which equipment is essential to find out if dissolving a salt in water is an exothermic process?

	balance	pipette	stop-clock	thermometer
A	✗	✗	✗	✓
B	✓	✗	✗	✓
C	✗	✓	✗	✓
D	✓	✗	✓	✗

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3 Iodine, I, has a lower relative atomic mass than tellurium, Te, but is placed after it in the Periodic Table.



Which statement explains why iodine is placed after tellurium in the Periodic Table?

A Iodine has fewer neutrons than tellurium.

B Iodine has fewer protons than tellurium.

C Iodine has more neutrons than tellurium.

D Iodine has more protons than tellurium.

4 Which statement about the isotopes of an element is correct?

A Their physical properties are different because they have different proton numbers.

B Their atomic masses are different because they have different numbers of electron shells.

C They have the same chemical properties because they have the same number of electrons in their outer shells.

D They have the same physical properties because they have the same number of neutrons in their nuclei.

5 Which two molecules contain the same number of electrons?

A Cl_2 and SO_2

B CH_4 and H_2O

C CO and NH_3

D CO_2 and HCl

6 Which statement describes the lattice structure of a metal?

A The lattice consists of alternating positive ions and negative ions.

B The lattice consists of neutral atoms arranged in layers.

C The lattice consists of positive ions in a ‘sea of electrons’.

D The lattice consists of neutral atoms in a ‘sea of electrons’.

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7 Which gas sample contains the most molecules?

A 24 dm^3 of carbon dioxide, CO_2

B 4 g of hydrogen, H_2

C 36 dm^3 of hydrogen chloride, HCl

D 14 g of nitrogen, N_2

8 A student mixed together 25.0 cm^3 of 1.00 mol/dm^3 hydrochloric acid and 25.0 g of calcium carbonate.

$$2HCl(aq) + CaCO_3(s) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

What is the maximum volume of carbon dioxide gas that could be collected at room temperature and pressure?

A 300 dm^3 **B** 6.00 dm^3 **C** 0.600 dm^3 **D** 0.300 dm^3

9 Iron can react with sulfur to form two ionic compounds.

The iron is present as Fe^{2+} in one compound and as Fe^{3+} in the other compound.

The sulfur ion is present as S^{2-} in both compounds.

What are the formulae of the two compounds?

A FeS and Fe_2S_3

B FeS and Fe_3S_2

C FeS_2 and Fe_3S_2

D FeS_2 and Fe_2S_3

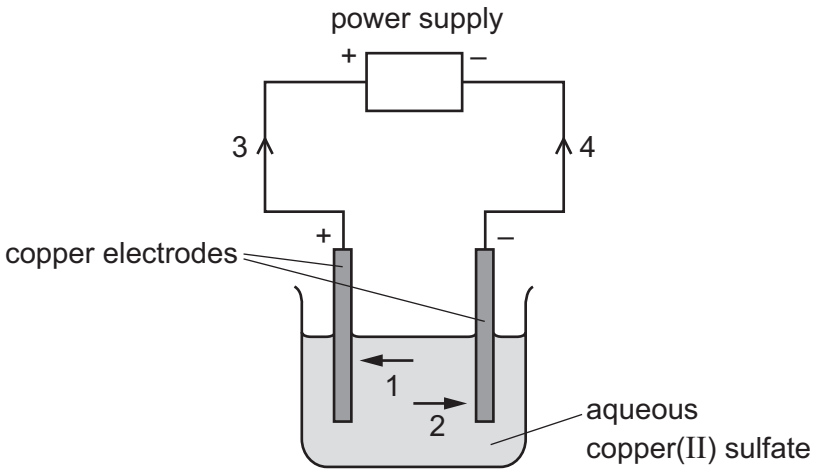
10 Aqueous copper(II) sulfate is electrolysed using carbon electrodes.

What is the product at each electrode?

	product at the positive electrode	product at the negative electrode
A	copper	oxygen
B	hydrogen	oxygen
C	oxygen	copper
D	oxygen	hydrogen

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11 The diagram shows a circuit used to electrolyse aqueous copper(II) sulfate.



Which arrows indicate the movement of the copper ions in the electrolyte and of the electrons in the external circuit?

	copper ions	electrons
A	1	3
B	1	4
C	2	3
D	2	4

12 Methane burns in an excess of oxygen. The equation is shown.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$

The bond energies are shown in the table.

bond	bond energy in kJ / mol
C–H	+410
C=O	+805
O–H	+460
O=O	+496

What is the energy change for the reaction?

A +818 kJ / mol

B +102 kJ / mol

C –359 kJ / mol

D –818 kJ / mol

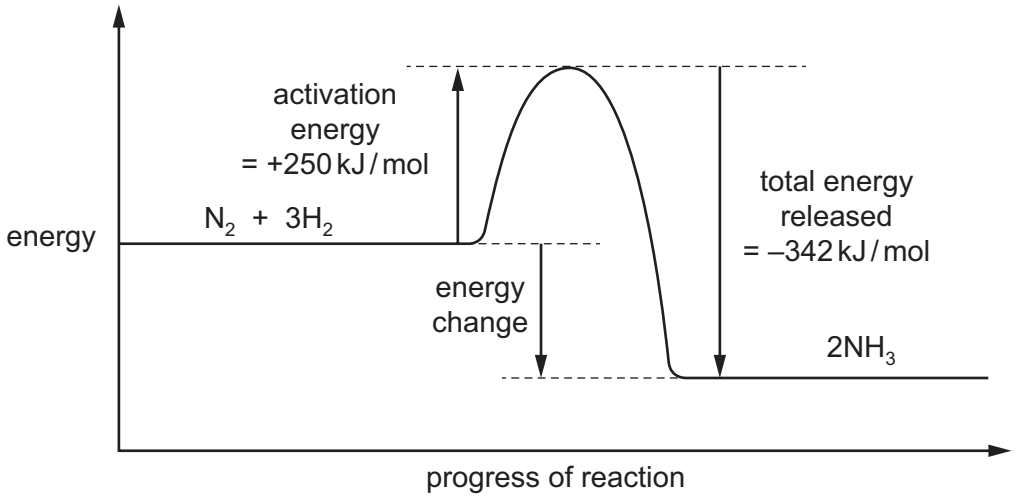
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[Turn over

13 The equation for the formation of ammonia is shown.

$$N_2 + 3H_2 \rightarrow 2NH_3$$

The energy level diagram for the reaction is shown.



What is the energy change for the reaction?

A –592 kJ / mol

B –92 kJ / mol

C +92 kJ / mol

D +592 kJ / mol

14 The effects of a change in conditions on a chemical reaction are listed.

1 The total number of collisions per minute increased.

2 The number of effective collisions per minute increased.

3 The average energy of the particles increased.

Which change in conditions caused all of these effects?

A addition of a catalyst

B increasing the concentration of a solution of a reactant

C increasing the surface area of a solid reactant

D increasing the temperature

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15 When $BiCl_3$ reacts with water, a white precipitate of $BiOCl$ is formed. The equation for the reaction is shown.

$$BiCl_3(aq) + H_2O(l) \rightleftharpoons BiOCl(s) + 2HCl(aq)$$

Which statements are correct?

1 The reaction is reversible.

2 When dilute hydrochloric acid is added to the reaction mixture, more of the white precipitate forms.

3 When aqueous sodium hydroxide is added to the reaction mixture, more of the white precipitate forms.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

16 An excess of iron(II) chloride is added to acidified potassium manganate(VII).

Which statements are correct?

1 The purple colour disappears.

2 Iron(II) is reduced to iron(III).

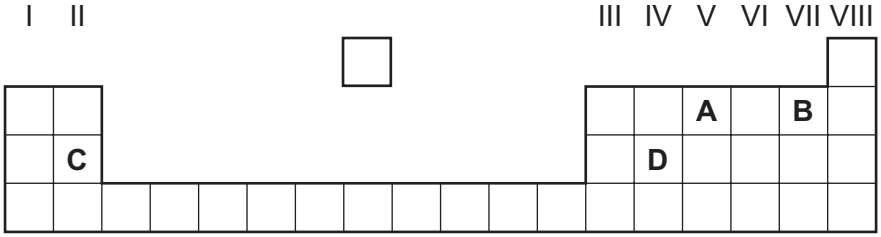
3 Manganate(VII) ions are oxidised to manganese(II) ions.

4 Potassium manganate(VII) is an oxidising agent.

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

17 Part of the Periodic Table is shown.

Which element forms an oxide that reacts with dilute acid to form a salt and water?



18 Aqueous sodium hydroxide is added to solid Q in a test-tube.

A gas is produced which turns damp red litmus blue.

What is Q?

A aluminium

B ammonia

C ammonium chloride

D sodium nitrate

19 Potassium hydroxide is a base.

Which statement describes a reaction of potassium hydroxide?

A Chlorine is formed when it is heated with ammonium chloride.

B It turns Universal Indicator green.

C It reacts with an acid to produce a salt and water.

D It turns methyl orange red.

20 Some general rules for the solubility of salts in water are listed.

- Carbonates are insoluble (except ammonium carbonate, potassium carbonate and sodium carbonate).
- Chlorides are soluble (except lead(II) chloride and silver chloride).
- Nitrates are soluble.
- Sulfates are soluble (except barium sulfate, calcium sulfate and lead(II) sulfate).

Which substances produce an insoluble salt when aqueous solutions of them are mixed?

A barium chloride and magnesium nitrate

B calcium chloride and ammonium nitrate

C silver nitrate and zinc chloride

D sodium carbonate and potassium sulfate

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21 Elements in Group I of the Periodic Table react with water.

Which row describes the products made in the reaction and the trend in reactivity of the elements?

	products	trend in reactivity
A	metal hydroxide and hydrogen	less reactive down the group
B	metal hydroxide and hydrogen	more reactive down the group
C	metal oxide and hydrogen	less reactive down the group
D	metal oxide and hydrogen	more reactive down the group

22 The equation shows the reaction between a halogen and aqueous bromide ions.

$$X_2 + 2Br^- \rightarrow 2X^- + Br_2$$

.....1..... .....2..... .....3.....

Which words complete gaps 1, 2 and 3?

	1	2	3
A	chlorine	brown	colourless
B	chlorine	colourless	brown
C	iodine	brown	colourless
D	iodine	colourless	brown

23 An inert gas R is used to fill weather balloons.

Which descriptions of R are correct?

	number of outer shell electrons in atoms of R	structure of gas R
A	2	diatomic molecules
B	2	single atoms
C	8	diatomic molecules
D	8	single atoms

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24 A student heated copper(II) carbonate and copper(II) nitrate in separate test-tubes.

Both compounds decomposed.

Which row shows the gases produced from each reaction?

	copper(II) carbonate	copper(II) nitrate
A	carbon dioxide	nitrogen dioxide only
B	carbon dioxide	oxygen only
C	carbon dioxide	oxygen and nitrogen dioxide
D	oxygen	oxygen and nitrogen dioxide

25 Metal X reacts with steam but not with cold water.

What is X?

A calcium

B copper

C sodium

D zinc

26 Which row shows uses of the metals listed?

	aluminium	copper	mild steel
A	aircraft manufacture	food containers	cutlery
B	cutlery	electrical wiring	chemical plant
C	electrical wiring	aircraft manufacture	cooking utensils
D	food containers	cooking utensils	car bodies

27 Aluminium objects do not need protection from corrosion.

Iron objects must be protected from corrosion.

Why does aluminium resist corrosion?

A Aluminium does not form ions easily.

B Aluminium does not react with water or air.

C Aluminium has a protective oxide layer.

D Aluminium is below iron in the reactivity series.

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28 Which statement describes the role of iron in the Haber process?

A It is used as a catalyst.

B It is used as a reducing agent.

C It is used to condense the ammonia gas into a liquid.

D It is used to increase the yield of ammonia.

29 Which statement about air pollutants is **not** correct?

A Carbon monoxide is formed from the complete combustion of petroleum.

B Lead compounds are formed from some types of petrol.

C Oxides of nitrogen are formed from the combustion reactions inside car engines.

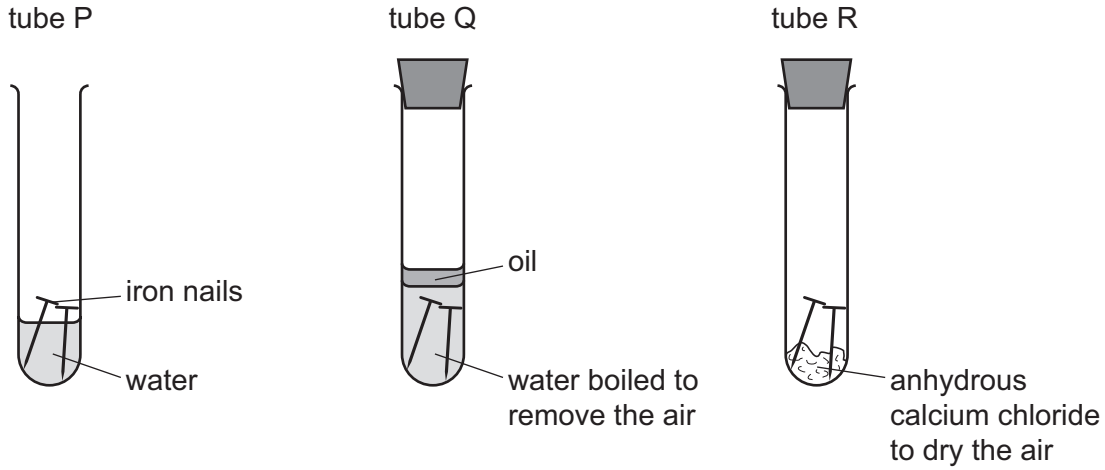
D Sulfur dioxide is formed from the combustion of coal.

30 Argon is a noble gas used to fill light bulbs.

What is the approximate percentage of argon in air?

A 1% **B** 20% **C** 79% **D** 99%

31 The diagrams show experiments involving the rusting of iron.



A student predicted the following results.

1 In tube P, the iron nails rust.

2 In tube Q, the iron nails do not rust.

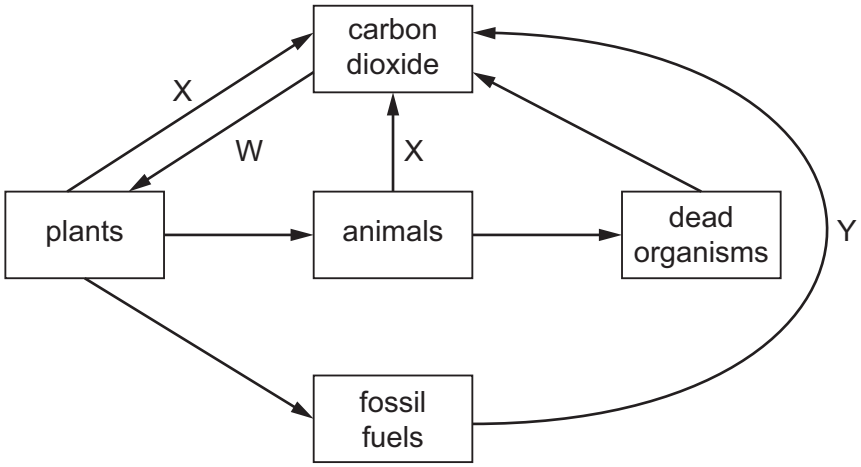
3 In tube R, the iron nails do not rust.

Which predictions are correct?

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

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32 A diagram of the carbon cycle is shown.



Which processes are represented by the letters W, X and Y?

	W	X	Y
A	photosynthesis	combustion	respiration
B	photosynthesis	respiration	combustion
C	respiration	combustion	photosynthesis
D	respiration	photosynthesis	combustion

33 Which statement about sulfur or one of its compounds is correct?

A Sulfur occurs naturally as the element sulfur.

B Sulfur dioxide is used to kill bacteria in drinking water.

C Sulfuric acid is a weak acid.

D Dilute sulfuric acid is a dehydrating agent.

34 Which reaction is endothermic?

A $CaCO_3 \rightarrow CaO + CO_2$

B $CaO + 2HCl \rightarrow CaCl_2 + H_2O$

C $2Ca + O_2 \rightarrow 2CaO$

D $Ca + 2HCl \rightarrow CaCl_2 + H_2$

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35 Which equation representing a reaction of methane is correct?

A $CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$

B $CH_4 + Cl_2 \rightarrow CH_4Cl_2$

C $CH_4 + Cl_2 \rightarrow CH_2Cl_2 + H_2$

D $2CH_4 + 2Cl_2 \rightarrow 2CH_3Cl + Cl_2 + H_2$

36 Which two compounds are molecules which both contain a double bond?

A ethane and ethanoic acid

B ethane and ethanol

C ethene and ethanoic acid

D ethene and ethanol

37 Ethanol can be formed by:

1 fermentation

2 reaction between steam and ethene.

Which of these processes use a catalyst?

	1	2
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

38 When the alcohol $CH_3CH_2CH_2OH$ reacts with the carboxylic acid $CH_3CH_2CH_2COOH$ an ester is formed.

What is the name and structural formula of this ester?

	name	structural formula
A	butyl propanoate	$CH_3CH_2COOCH_2CH_2CH_2CH_3$
B	butyl propanoate	$CH_3CH_2CH_2COOCH_2CH_2CH_3$
C	propyl butanoate	$CH_3CH_2COOCH_2CH_2CH_2CH_3$
D	propyl butanoate	$CH_3CH_2CH_2COOCH_2CH_2CH_3$

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39 A solution of ethanol and water is left to stand in an open beaker in a warm room for three weeks.

Which statement explains what happens to the ethanol in the solution?

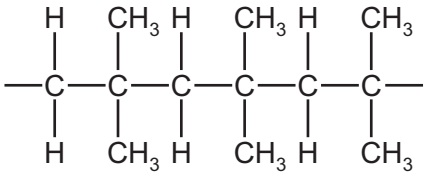
A The ethanol is dehydrated to ethene.

B The ethanol is hydrolysed to ethene.

C The ethanol is oxidised to ethanoic acid.

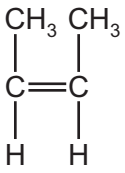
D The ethanol is reduced to ethanoic acid.

40 The structure of a polymer is shown.

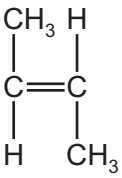


Which monomer is used to make this polymer?

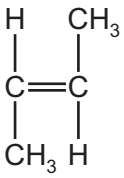
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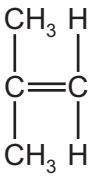
B



C



D



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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key

atomic number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).