Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/22**

Paper 2 Multiple Choice (Extended) **February/March 2020**

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages. Blank pages are indicated.

1 The formula of methane is CH_4 and the formula of ethane is C_2H_6.

Which row describes diffusion and the relative rates of diffusion of methane and ethane?

	description of diffusion	relative rate of diffusion
A	particles move from a high concentration to a low concentration	ethane diffuses more quickly than methane
B	particles move from a high concentration to a low concentration	methane diffuses more quickly than ethane
C	particles move from a low concentration to a high concentration	ethane diffuses more quickly than methane
D	particles move from a low concentration to a high concentration	methane diffuses more quickly than ethane

2 Which test is used to show that a sample of water is pure?

A Evaporate the water to see if any solids remain.

B Heat the water to check its boiling point.

C Test with anhydrous cobalt(II) chloride.

D Use universal indicator paper to check its pH.

3 Chromatography is used to separate and identify the components in both coloured and colourless mixtures.

For colourless mixtures the chromatogram has to be treated with another chemical.

What is the name of this type of chemical?

A colouring agent

B display agent

C finding agent

D locating agent

4 Lithium reacts with fluorine to form the compound lithium fluoride.

Which statement about this reaction is correct?

A Each fluorine atom gains one electron.

B Each fluorine atom gains two or more electrons.

C Each fluorine atom loses one electron.

D Each fluorine atom loses two or more electrons.

5 $^{14}_{6}C$ and $^{12}_{6}C$ are isotopes of carbon.

Which statement about these isotopes is correct?

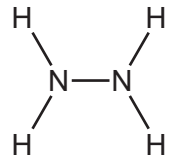
A $^{12}_{6}C$ is more reactive than $^{14}_{6}C$ because the atoms have less mass.

B $^{12}_{6}C$ is more reactive than $^{14}_{6}C$ because the atoms have different numbers of neutrons.

C The reactions of $^{12}_{6}C$ are similar to $^{14}_{6}C$ because they have the same number of outer shell electrons.

D The reactions of $^{12}_{6}C$ are similar to $^{14}_{6}C$ because they have the same number of protons in the nucleus.

6 The molecular structure of hydrazine, N_2H_4, is shown.



Which description of the bonding in hydrazine is **not** correct?

A Each nitrogen atom has a non-bonding pair of electrons.

B Each nitrogen atom has four bonding pairs of electrons.

C Each nitrogen atom shares one of its electrons with a nitrogen atom.

D Each nitrogen atom shares two of its electrons with hydrogen atoms.

7 Solid X has a high boiling point.

Its structure has positive ions surrounded by a sea of electrons.

Which other properties does solid X have?

A brittle and an electrical conductor

B brittle and an insulator

C malleable and an electrical conductor

D malleable and an insulator

8 The formulae of some ions are shown.

positive ions	negative ions
Al^{3+}	Cl^{-}
Fe^{2+}	N^{3-}
Mg^{2+}	NO_3^{-}
Na^{+}	O^{2-}
Zn^{2+}	SO_4^{2-}

In which row is the formula **not** correct?

	compound	formula
A	aluminium oxide	Al_2O_3
B	iron(II) nitride	Fe_2N_3
C	sodium sulfate	Na_2SO_4
D	zinc nitrate	$Zn(NO_3)_2$

9 The equation for the decomposition of magnesium nitrate is shown.

$$2Mg(NO_3)_2(s) \rightarrow 2MgO(s) + 4NO_2(g) + O_2(g)$$

Which volume of gas is produced when 0.1 moles of magnesium nitrate is decomposed completely?

A $1.2\,dm^3$ **B** $4.8\,dm^3$ **C** $6.0\,dm^3$ **D** $8.4\,dm^3$

10 Which statements about the electrolysis of molten lead(II) bromide are correct?

1 Lead ions move to the anode and are oxidised.

2 Lead ions move to the cathode and are reduced.

3 Bromide ions move to the anode and are oxidised.

4 Bromide ions move to the cathode and are reduced.

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

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

Which statement is correct?

A Bubbles of hydrogen are formed at the anode.

B Bubbles of oxygen gas are formed at the cathode.

C Copper is deposited at the anode.

D The blue colour of the solution fades.

12 Nitrogen trifluoride, NF_3, is used in the manufacture of certain types of solar panels. The equation for the formation of nitrogen trifluoride is shown.

$$N_2 + 3F_2 \rightarrow 2NF_3$$

type of bond	bond energy ($kJ\,mol^{-1}$)
N≡N	+950
F–F	+150
N–F	+280

Using the table of bond energies, what is the energy change for this reaction?

A $-560\,kJ\,mol^{-1}$

B $-280\,kJ\,mol^{-1}$

C $+280\,kJ\,mol^{-1}$

D $+3080\,kJ\,mol^{-1}$

13 Which statements about hydrogen fuel cells are correct?

1 The reaction between hydrogen and oxygen is endothermic.

2 The waste product in a hydrogen fuel cell is water.

3 A chemical reaction in the cell produces hydrogen which is used as the fuel.

4 A hydrogen fuel cell is used to generate electricity.

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

14 Which change is a physical change?

A Copper(II) carbonate changes colour from green to black when it is heated, and stays black when it cools.

B Ethanol reacts with oxygen to form carbon dioxide and water.

C Hydrogen peroxide decomposes into water and oxygen when it is boiled.

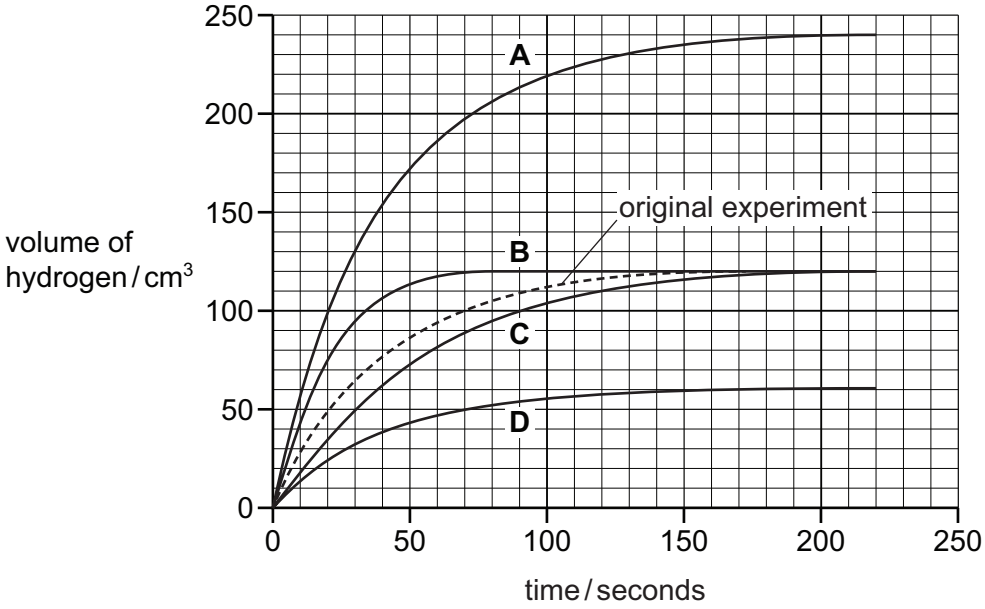
D Ice forms liquid water when it is heated.

15 A student adds excess magnesium ribbon to 10 cm^3 of 0.5 mol / dm^3 sulfuric acid.

The hydrogen gas is collected and its volume measured every 10 seconds.

The experiment is repeated using the same mass of magnesium ribbon with 5 cm^3 of 0.5 mol / dm^3 sulfuric acid added to 5 cm^3 of water.

Which graph shows the results of the second experiment?



16 An equilibrium reaction is shown.

$$N_2O_4(g) \rightleftharpoons 2NO_2(g)$$

The forward reaction is endothermic.

What is the effect of changing the temperature and pressure on the equilibrium position?

	increasing temperature	increasing pressure
A	moves to the left	moves to the left
B	moves to the left	moves to the right
C	moves to the right	moves to the left
D	moves to the right	moves to the right

17 In which reaction is the underlined compound acting as a reducing agent?

A $\underline{CO_2} + C \rightarrow 2CO$

B $2CuO + \underline{C} \rightarrow 2Cu + CO_2$

C $\underline{Fe_2O_3} + 3CO \rightarrow 2Fe + 3CO_2$

D $CaCO_3 + \underline{2HCl} \rightarrow CaCl_2 + H_2O + CO_2$

18 X, Y and Z are oxides of elements in the same row of the Periodic Table.

Some information about each oxide is shown.

oxide	solubility in water	ability to neutralise an acid	ability to neutralise an alkali
X	soluble	✗	✓
Y	insoluble	✓	✓
Z	slightly soluble	✓	✗

key

✓ = able

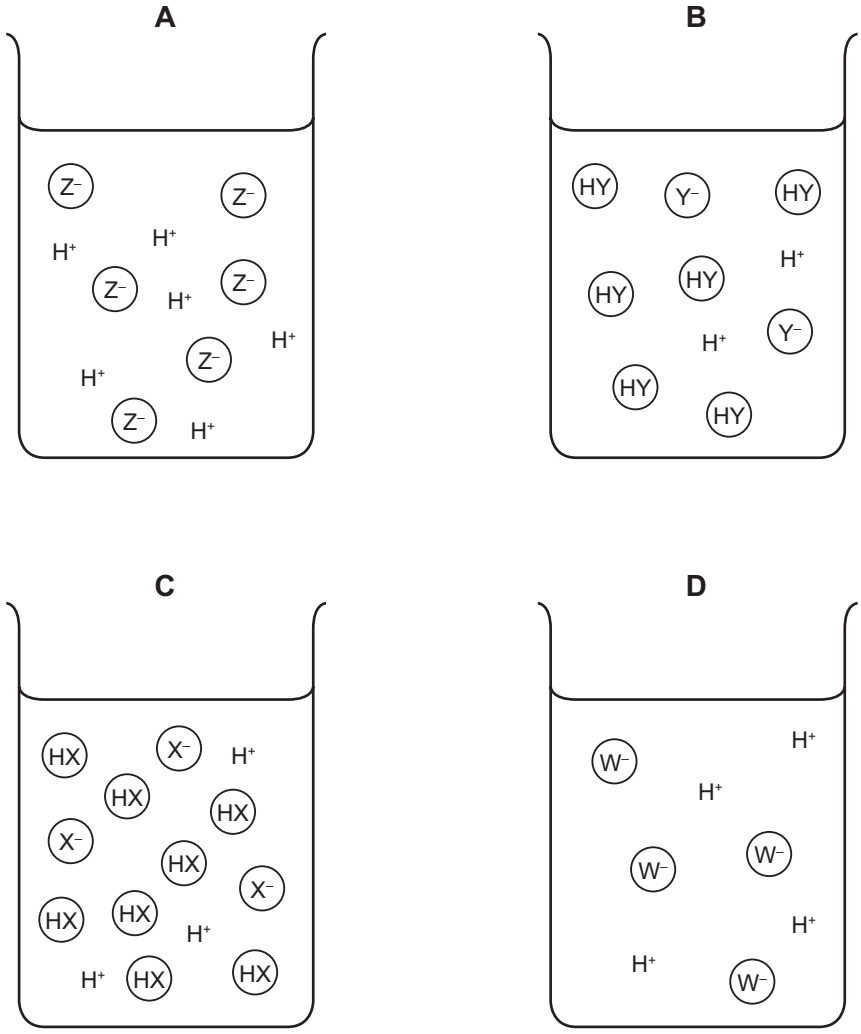
✗ = not able

Which types of oxides are X, Y and Z?

	X	Y	Z
A	acidic	amphoteric	basic
B	amphoteric	basic	basic
C	basic	amphoteric	acidic
D	basic	acidic	amphoteric

19 Four different acids are dissolved in water.

Which beaker contains the most concentrated strong acid solution?



20 The following substances can be reacted together to prepare salts.

1 copper(II) oxide and excess hydrochloric acid

2 hydrochloric acid and excess sodium hydroxide

3 hydrochloric acid and excess zinc carbonate

In which reactions can the excess reactant be separated from the solution by filtration?

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

21 Salt S is dissolved in water and three tests are carried out on the solution.

	test	result
1	aqueous sodium hydroxide is added	green precipitate formed, insoluble in excess sodium hydroxide
2	dilute nitric acid is added	no reaction
3	aqueous barium nitrate is added to the acidified solution from test 2	white precipitate formed

What is the identity of S?

A copper(II) chloride

B copper(II) sulfate

C iron(II) chloride

D iron(II) sulfate

22 Which statement about the Periodic Table is correct?

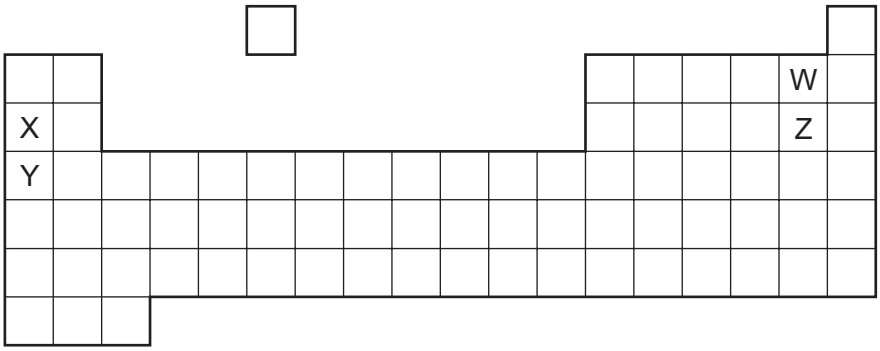
A Most metallic elements are on the left.

B Elements in the same period have the same number of outer electrons.

C Elements on the left are usually gases.

D The relative atomic mass of the elements increases from right to left.

23 The diagram shows elements W, X, Y and Z in a section of the Periodic Table.



Which statement about the reactivity of the elements is correct?

A X is more reactive than Y, and W is more reactive than Z.

B X is more reactive than Y, and Z is more reactive than W.

C Y is more reactive than X, and W is more reactive than Z.

D Y is more reactive than X, and Z is more reactive than W.

24 Some properties of substances are listed.

1 They conduct electricity.

2 They have low densities.

3 They have high melting points.

4 They are malleable.

Which properties are shown by transition metals?

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

25 Sodium is a Group I metal.

Which property, that is typical of most metals, is **not** shown by sodium?

A conductor of heat

B high melting point

C malleable

D shiny

26 Four metals, iron, copper, magnesium and Y, are heated separately with their oxides.

The results are shown.

metal	magnesium oxide	Y oxide	copper oxide	iron oxide
Y	✗	✗	✓	✓
magnesium	✗	✓	✓	✓
copper	✗	✗	✗	✗
iron	✗	✗	✗	✗

key

✓ = reacts

✗ = no reaction

What is the order of reactivity of the metals, least reactive first?

	least reactive ⟶ most reactive			
A	copper	iron	Y	magnesium
B	copper	Y	iron	magnesium
C	magnesium	iron	Y	copper
D	magnesium	Y	iron	copper

27 Aluminium is extracted from bauxite by electrolysis.

Which statement is correct?

A Aluminium ions are oxidised to form aluminium.

B The cathode has to be replaced regularly because it reacts with the oxygen which is formed.

C Cryolite is added to remove impurities.

D Carbon dioxide is produced at the anode.

28 Some properties of aluminium are listed.

1 It conducts heat.

2 It has a low density.

3 It is strong.

4 It is resistant to corrosion.

Which of these properties make aluminium suitable for making food containers for chilled food products?

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

29 Water is treated at a waterworks to make it fit to drink.

What is present in the water when it leaves the waterworks?

A bacteria only

B bacteria and insoluble substances

C chlorine compounds only

D chlorine compounds and soluble substances

30 Sulfur dioxide, carbon monoxide and oxides of nitrogen are common gaseous pollutants found in the air.

Which pollutants contribute to acid rain?

A carbon monoxide and sulfur dioxide

B oxides of nitrogen and sulfur dioxide

C oxides of nitrogen only

D sulfur dioxide only

31 Oxides of nitrogen, such as NO and NO_2, are formed in the petrol engines of cars.

They are removed from the exhaust gases by reactions in the car's catalytic converter.

Which row describes how oxides of nitrogen are formed in a petrol engine, and a reaction that happens in the catalytic converter?

	how oxides of nitrogen are formed	a reaction that happens in the catalytic convertor
A	by the reaction between nitrogen and oxygen from the air	$2NO + 2CO \rightarrow N_2 + 2CO_2$
B	by the reaction between nitrogen and oxygen from the air	$2NO + 2H_2 \rightarrow N_2 + 2H_2O$
C	by the reaction between nitrogen compounds in petrol and oxygen from the air	$2NO + 2CO \rightarrow N_2 + 2CO_2$
D	by the reaction between nitrogen compounds in petrol and oxygen from the air	$2NO + 2H_2 \rightarrow N_2 + 2H_2O$

32 Zinc is used to cover iron to prevent it from rusting.

Why is zinc a suitable metal to use?

A Iron is more reactive than zinc.

B Iron atoms are bigger than zinc atoms.

C Zinc is more reactive than iron.

D Zinc atoms are bigger than iron atoms.

33 Fertilisers are mixtures of different compounds used to increase the growth of crops.

Which pair of substances contain the three essential elements for plant growth?

A ammonium nitrate and calcium phosphate

B ammonium nitrate and potassium chloride

C ammonium phosphate and potassium chloride

D potassium nitrate and calcium carbonate

34 Which row describes the conditions used in the manufacture of sulfuric acid by the Contact process?

	catalyst	pressure	temperature
A	iron	high	high
B	iron	low	low
C	vanadium(V) oxide	high	low
D	vanadium(V) oxide	low	high

35 Petroleum is an important raw material that is separated into useful products.

Which terms describe petroleum and the method used to separate it?

	description	separation method
A	compound	cracking
B	compound	fractional distillation
C	mixture	cracking
D	mixture	fractional distillation

36 Which statements about propene are correct?

1 Propene contains only single bonds.

2 Propene decolourises bromine water.

3 Propene is obtained by cracking.

4 Propene is a hydrocarbon.

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

37 Which row describes the production of ethanol and its properties?

	can be made from glucose	can be made from ethene	is used as a fuel	is used as a solvent
A	✓	✓	✓	✓
B	✓	✗	✓	✓
C	✗	✓	✓	✗
D	✗	✓	✗	✓

key

✓ = yes

✗ = no

38 Ethanoic acid is a typical carboxylic acid.

Which statement about ethanoic acid is correct?

A It can be oxidised to produce ethanol.

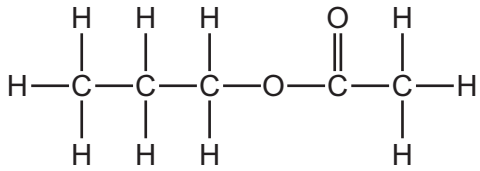
B It is a proton acceptor.

C It is fully dissociated in water.

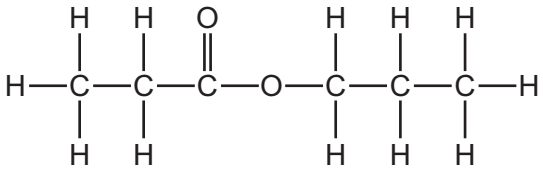
D It reacts with ethanol to produce ethyl ethanoate and water.

39 Which structure represents the ester made from ethanoic acid and propanol?

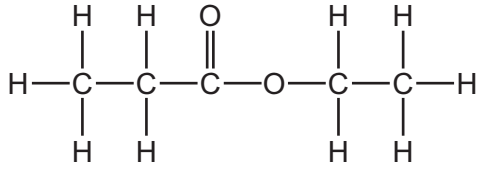
A



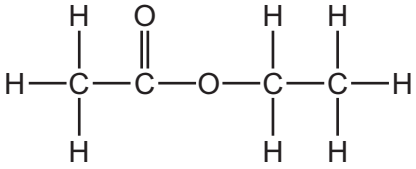
B



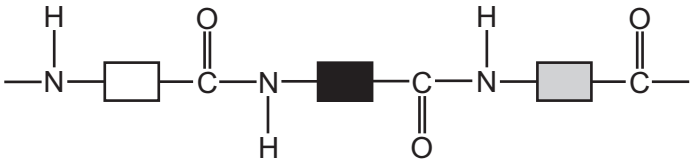
C



D



40 The structure of a polymer is shown.



Which statements about the polymer are correct?

1 The polymer is nylon.

2 The polymer is formed by condensation polymerisation.

3 There are ester linkages between the monomers.

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

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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.).