Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/22**

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

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1 Which gas has the slowest rate of diffusion?

A H_2 **B** NH_3 **C** CH_4 **D** CO_2

2 A chromatography experiment is carried out to analyse the pigments present in four different types of leaf. The student carrying out the experiment forgot to complete his table of results, which is shown.

plant leaf	number of pigments identified	colour of identified pigments	distance travelled by the solvent front (cm)	distance travelled from the origin by each pigment (cm)	R_f value
maple	**F**	green / yellow	3.7	green: 3.0 yellow: 3.1	green: 0.81 yellow: 0.83
laurel	2	green / yellow	**G**	green: 2.5 yellow: 2.5	green: 0.78 yellow: 0.78
lime	3	green / yellow / orange	3.5	green: 2.9 yellow: 3.0 orange: 2.7	green: 0.83 yellow: 0.86 yellow: 0.77
ash	3	green / yellow / orange	3.5	green: 2.8 yellow: 3.0 orange: 2.7	green: 0.80 yellow: **H** orange: 0.77

Which row identifies the values of **F**, **G** and **H**?

	F	**G**	**H**
A	2	3.2	0.80
B	3	3.5	0.83
C	2	3.2	0.86
D	3	3.5	0.78

3 Which statement about isotopes is correct?

A They have different proton numbers.

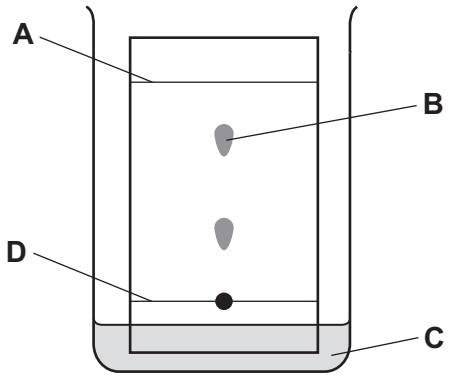
B They have different chemical properties.

C They have the same nucleon number.

D They have the same number of electrons in their outer shell.

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4 In the chromatography experiment shown, which label represents the solvent front?



5 Different methods of separation rely on substances having different properties.

Which property does distillation make use of?

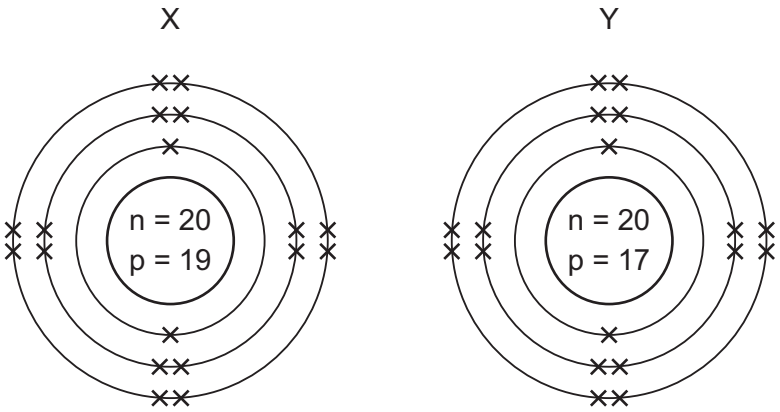
A boiling point

B colour

C particle size

D solubility in different solvents

6 The arrangements of the electrons in two ions formed from elements X and Y are shown.



Which equation represents the reaction between elements X and Y?

A $X_2 + 2Y \rightarrow 2X^+ + 2Y^-$

B $X_2 + 2Y \rightarrow 2X^- + 2Y^+$

C $2X + Y_2 \rightarrow 2X^+ + 2Y^-$

D $2X + Y_2 \rightarrow 2X^- + 2Y^+$

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[Turn over

7 Which row identifies compounds that contain single covalent bonds only, double covalent bonds only or both single and double covalent bonds?

	single covalent bonds only	double covalent bonds only	both single and double covalent bonds
A	C_2H_4	CH_3OH	CO_2
B	CH_3OH	C_2H_4	CO_2
C	CH_3OH	CO_2	C_2H_4
D	CO_2	C_2H_4	CH_3OH

8 Ethyl methanoate, $HCOOC_2H_5$, burns in excess oxygen to produce carbon dioxide and water.

The equation is shown.

$$2HCOOC_2H_5 + xO_2 \rightarrow 6CO_2 + 6H_2O$$

What is the value of x?

A 2 **B** 7 **C** 9 **D** 18

9 Rubidium is in Group I of the Periodic Table and bromine is in Group VII.

Rubidium reacts with bromine to form an ionic compound.

Which row shows the electron change taking place for rubidium and the correct formula of the rubidium ion?

	electron change	formula of ion formed
A	electron gained	Rb^+
B	electron gained	Rb^-
C	electron lost	Rb^+
D	electron lost	Rb^-

10 Which statement explains why graphite is used as a lubricant?

A All bonds between the atoms are weak.

B It conducts electricity.

C It has a low melting point.

D Layers in the structure can slide over each other.

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11 The relative atomic mass of chlorine is 35.5.

When calculating relative atomic mass, which particle is the mass of a chlorine atom compared to?

A a neutron

B a proton

C an atom of carbon-12

D an atom of hydrogen-1

12 Universal indicator solution is added to a neutral solution of concentrated aqueous sodium chloride.

The solution, which contains H^+ (hydrogen), Na^+ (sodium), Cl^- (chloride) and OH^- (hydroxide) ions, is electrolysed.

The product at the cathode is hydrogen gas and the product at the anode is chlorine gas.

What happens to the colour of the indicator **in the solution** during electrolysis?

A The colour changes from blue to green.

B The colour changes from blue to red.

C The colour changes from green to blue.

D The colour changes from green to red.

13 What is the empirical formula of an oxide of iron, formed by reacting 2.24 g of iron with 0.96 g of oxygen?

A FeO **B** Fe_2O **C** Fe_2O_3 **D** Fe_3O_4

14 The combustion of methane is exothermic.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

Which statement about this reaction is correct?

A The energy needed to break the bonds in methane and oxygen is greater than the energy released in making new bonds in carbon dioxide and water.

B The energy needed to break the bonds in methane and oxygen is less than the energy released in making new bonds in carbon dioxide and water.

C The energy released in breaking bonds in methane and oxygen is greater than the energy needed to make new bonds in carbon dioxide and water.

D The energy released in breaking bonds in methane and oxygen is less than the energy needed to make new bonds in carbon dioxide and water.

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15 Hydrogen reacts with oxygen in a fuel cell.

$$2H_2 + O_2 \rightarrow 2H_2O$$

The reaction is exothermic.

286 kJ of energy is released for every mole of water formed.

Which volume of hydrogen gas, measured at room temperature and pressure, would react with oxygen with the release of 7000 J of energy?

A 587 cm^3 **B** 1175 cm^3 **C** 587 dm^3 **D** 1175 dm^3

16 Which substance does **not** require oxygen in order to produce energy?

A coal

B hydrogen

C natural gas

D ^{235}U

17 Nitrogen, N_2, and hydrogen, H_2, can be converted into ammonia, NH_3, using a catalyst.

What is the purpose of the catalyst?

A to increase the amount of ammonia produced

B to increase the rate of reaction

C to reduce the amount of reactants needed

D to reduce the rate of reaction

18 Ammonia is produced by the Haber process. The equation is shown.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The forward reaction is exothermic.

Which statement is correct?

A Increasing pressure decreases the yield of ammonia, but speeds up the reaction.

B Increasing temperature decreases the yield of ammonia, but speeds up the reaction.

C Increasing the concentration of hydrogen and nitrogen results in a lower yield of ammonia.

D Increasing the temperature increases the yield of ammonia and speeds up the reaction.

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19 During the manufacture of sulfuric acid, sulfur dioxide is converted to sulfur trioxide.

$$2SO_2 + O_2 \rightarrow 2SO_3$$

Which type of reaction is this?

A displacement

B neutralisation

C oxidation

D thermal decomposition

20 The equation for a redox reaction is shown.

$$2FeSO_4 + Cl_2 + H_2SO_4 \rightarrow Fe_2(SO_4)_3 + 2HCl$$

Which element is reduced?

A chlorine

B iron

C oxygen

D sulfur

21 The equation shows a reaction between aqueous hydrogen bromide and aqueous ammonia.

$$HBr(aq) + NH_3(aq) \rightarrow NH_4^+(aq) + Br^-(aq)$$

Which statement describes the role of aqueous hydrogen bromide?

A It is a catalyst.

B It is a reducing agent.

C It is a proton acceptor.

D It is a proton donor.

22 The equations for three reactions are shown.

1 $Pb(NO_3)_2(aq) + 2KI(aq) \rightarrow PbI_2(s) + 2KNO_3(aq)$

2 $2AgNO_3(aq) + CuI_2(aq) \rightarrow Cu(NO_3)_2(aq) + 2AgI(s)$

3 $CuO(s) + H_2SO_4(aq) \rightarrow CuSO_4(aq) + H_2O(l)$

Which reactions are suitable for making a salt by precipitation?

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

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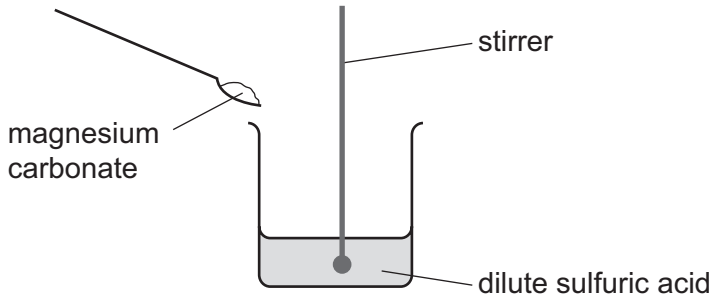
23 Zinc oxide is an amphoteric oxide.

Which row describes the reactions of zinc oxide?

	reaction with alkalis	reaction with acids
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

24 A student carries out an experiment to prepare pure magnesium sulfate crystals.

The diagram shows the first stage of the preparation.



He adds magnesium carbonate until no more reacts.

Which process should he use for the next stage?

A crystallisation

B evaporation

C filtration

D neutralisation

25 Which row about elements in the Periodic Table is correct?

	statement 1	statement 2
A	two elements in the same group have similar chemical properties	metals are on the left of the table
B	two elements in the same group have similar chemical properties	metals are on the right of the table
C	two elements in the same period have similar chemical properties	metals are on the left of the table
D	two elements in the same period have similar chemical properties	metals are on the right of the table

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26 A new element oxfordium, Ox, was discovered with the following properties.

solubility	electrical conduction	formula of element	bonding in a molecule of Ox_2
insoluble in water	doesn't conduct	Ox_2	Ox≡Ox

In which group of the Periodic Table should the new element be placed?

A Group III

B Group V

C Group VII

D Group VIII

27 A flammable gas needs to be removed from a tank at an industrial plant.

For safety reasons, an inert gas is used.

Which gas is suitable?

A argon

B hydrogen

C methane

D oxygen

28 Transition elements can have variable oxidation states.

Which pair of compounds shows a transition element in two different oxidation states?

A Cr_2O_3 and $Cr_2(SO_4)_3$

B Cu_2O and $CuCO_3$

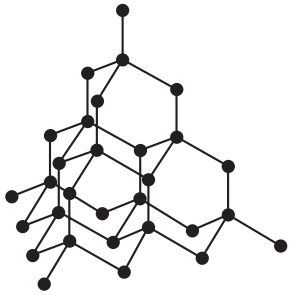
C ZnS and $ZnSO_4$

D NiO and $Ni(NO_3)_2$

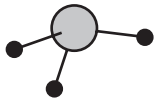
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29 Which diagram best represents the structure of a substance that is a good conductor of electricity at 25 °C?

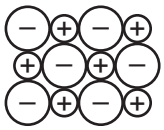
A



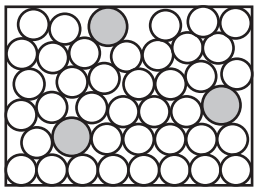
B



C



D



30 Why is aluminium metal unreactive with air?

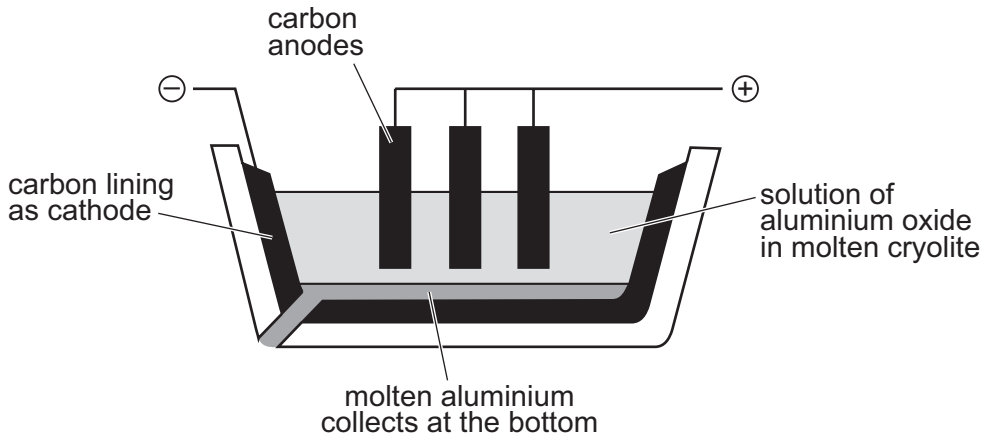
A It is covered with a layer of oxide.

B It is low in the reactivity series.

C It is produced by electrolysis of its oxide.

D It melts at a high temperature.

31 The apparatus used for the extraction of aluminium oxide by electrolysis is shown.



Which equation represents a reaction taking place at the anode?

A $O + 2e^- \rightarrow O^{2-}$

B $2O^{2-} \rightarrow O_2 + 4e^-$

C $Al^{3-} \rightarrow Al + 3e^-$

D $Al^{3+} + 3e^- \rightarrow Al$

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32 The results of tests on solid S and its aqueous solution are shown.

tests on solid S	tests on aqueous solution of S	
effect of heat	effect of aqueous sodium hydroxide	effect of aqueous ammonia
brown gas given off, together with a gas which relights a glowing splint	white ppt., soluble in excess, giving a colourless solution	white ppt., soluble in excess, giving a colourless solution

What is S?

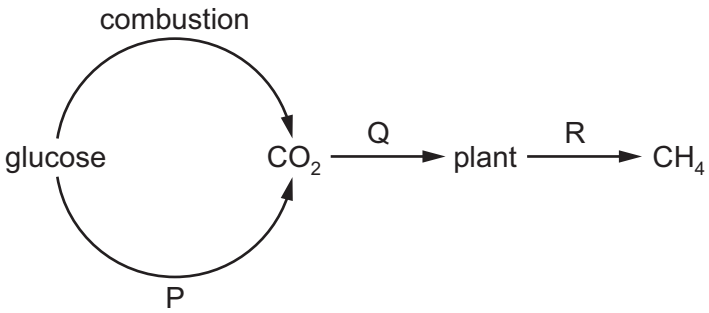
A aluminium nitrate

B aluminium sulfate

C zinc sulfate

D zinc nitrate

33 Part of the carbon cycle is shown.



What are processes P, Q and R?

	P	Q	R
A	decomposition	respiration	photosynthesis
B	respiration	photosynthesis	decomposition
C	respiration	decomposition	photosynthesis
D	photosynthesis	respiration	decomposition

34 The element sulfur is found in a number of different minerals.

Which mineral contains the greatest percentage by mass of sulfur?

A barite, $BaSO_4$

B galena, PbS

C gypsum, $CaSO_4$

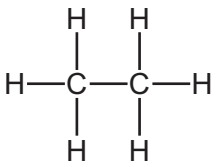
D pyrite, FeS_2

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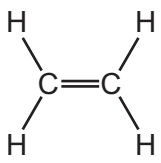
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35 Which structure represents a molecule of ethanol?

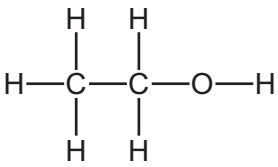
A



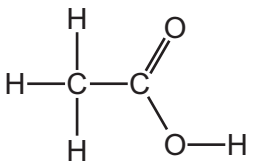
B



C

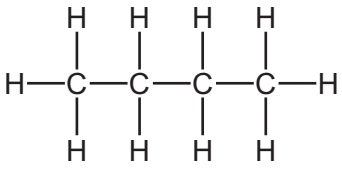


D

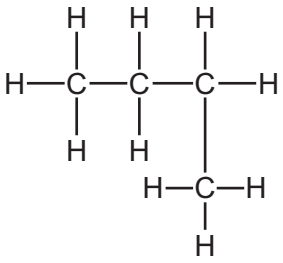


36 Which structures are structural isomers of each other?

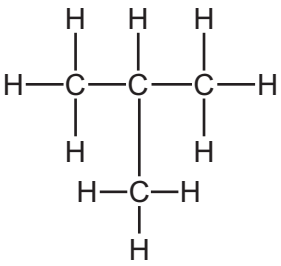
1



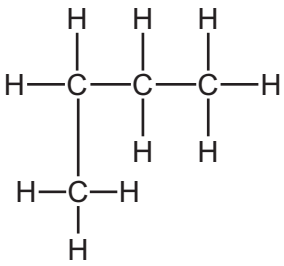
2



3



4



A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 3 only

D 2 and 4 only

37 Which molecule is **not** produced by an addition reaction of ethene?

A CH_3CH_3 **B** CH_2BrCH_2Br **C** CH_3CH_2OH **D** $CH_3CH_2CH_3$

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38 The flow chart shows the preparation of ethanol and some important chemistry of ethanol.

substance X $\xrightarrow{\text{fermentation}}$ ethanol $\xrightarrow{\text{process Y}}$ carbon dioxide + substance Z

What are X, Y and Z?

	X	Y	Z
A	yeast	combustion	oxygen
B	glucose	combustion	steam
C	glucose	polymerisation	water
D	yeast	fermentation	glucose

39 Which statement about nylon and *Terylene* is correct?

A Nylon and *Terylene* are made from monomers with C=C bonds.

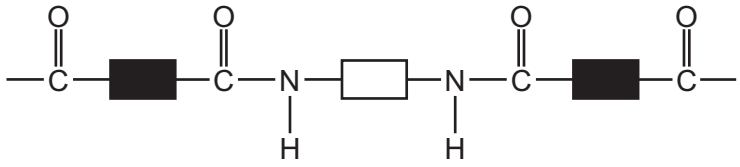
B Nylon and *Terylene* contain the same linkage.

C Nylon is a polyester.

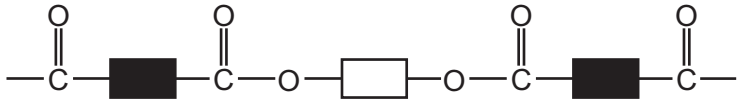
D *Terylene* is made from two different monomers.

40 Which diagram represents the structure of a protein?

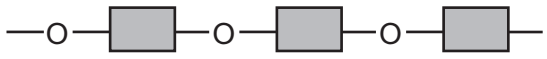
A



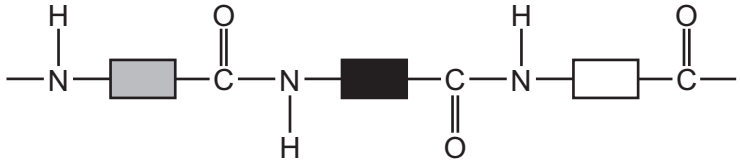
B



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.).