UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY **5070/12**

Paper 1 Multiple Choice **October/November 2013**

1 hour

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

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, 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.

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

1 When drops of bromine are placed on a table-top at one side of a room, the smell of [illegible] eventually be detected at the other side of the room.

What is **not** part of the explanation of this?

After evaporation, the bromine particles

A collide with air particles.

B move in a random way.

C spread out to occupy the total available space.

D vibrate from side to side.

2 Which elements exist as diatomic molecules at room temperature?

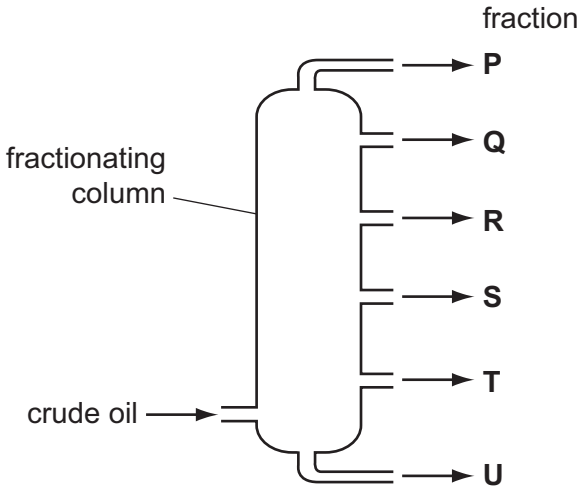
A hydrogen, oxygen, helium

B nitrogen, chlorine, neon

C nitrogen, oxygen, fluorine

D oxygen, chlorine, helium

3 The diagram shows the fractionation of crude oil.



Which statement is correct?

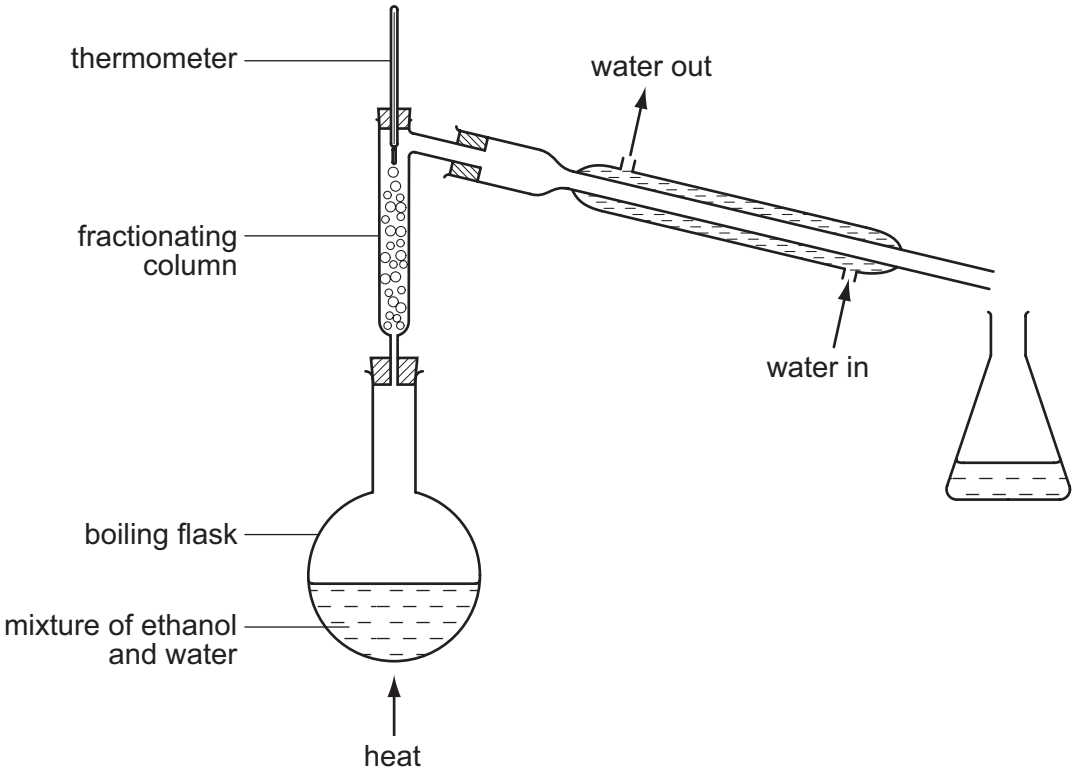
A Each fraction consists of a single compound.

B Fraction **P** has the highest boiling point.

C The highest temperature is at the top of the column.

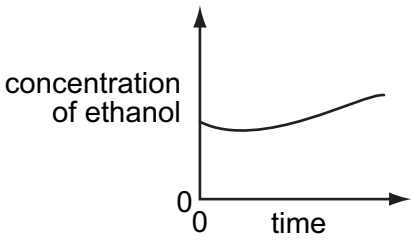
D The naphtha fraction is used as feedstock for the chemical industry.

4 The apparatus shown is used to distil a dilute solution of ethanol in water.
[B.P.: ethanol, 78 °C; water 100 °C]



Which graph shows the change in concentration of the ethanol in the boiling flask as the distillation proceeds?

A



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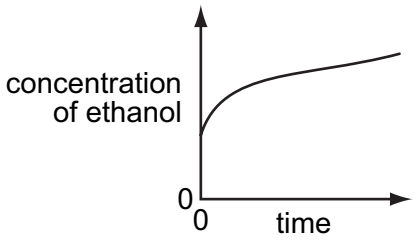
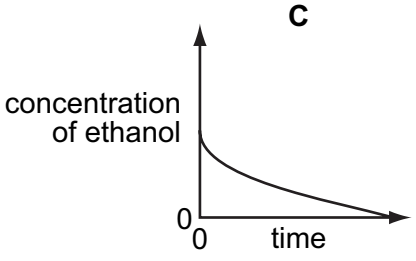
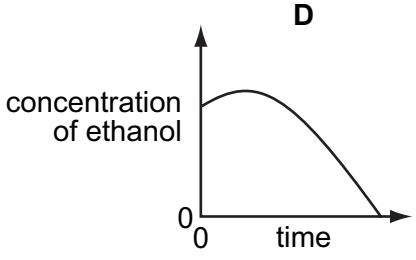


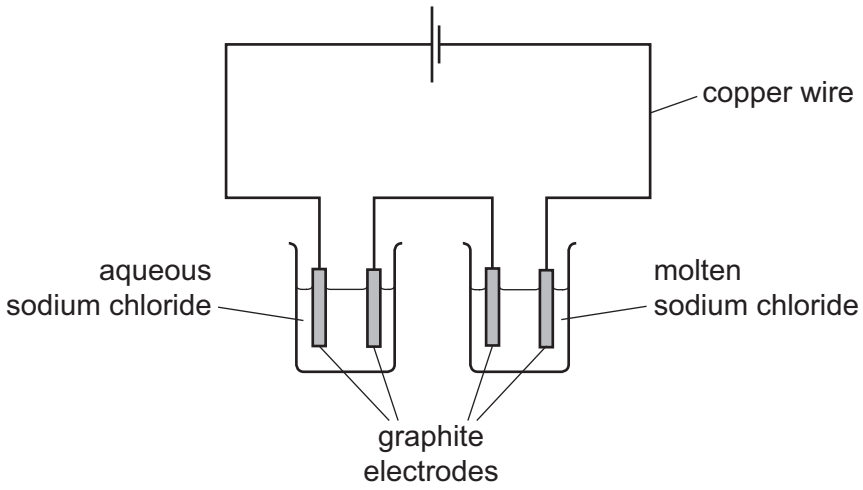
C



D



5 The diagram shows the electrolysis of aqueous sodium chloride and of molten sodium



Which substance in the diagram has both positive ions and mobile electrons?

A aqueous sodium chloride

B copper wire

C graphite electrodes

D molten sodium chloride

6 Substance X has a simple molecular structure and substance Y has a giant molecular structure.

Which row is correct?

	X could be	Y could be
A	an element only	an element only
B	an element only	an element or a compound
C	an element or a compound	an element only
D	an element or a compound	an element or a compound

7 The table gives some of the properties of four substances.

Which substance could be hydrogen chloride?

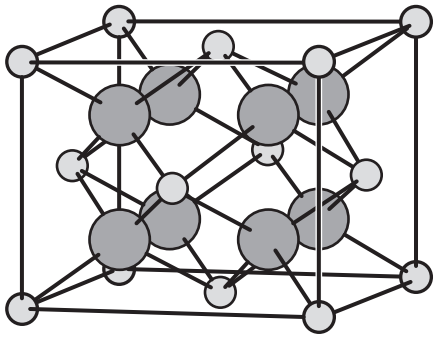
	melting point / °C	boiling point / °C	ability to conduct electricity	
			when liquid	in aqueous solution
A	–114	–85	none	good
B	–114	78	none	none
C	180	218	none	(insoluble)
D	808	1465	good	good

8 Aqueous silver nitrate is added to separate solutions of potassium chloride and sodium

What are the colours of the precipitates formed?

	colour of precipitate formed with chloride	colour of precipitate formed with iodide
A	white	white
B	white	yellow
C	yellow	white
D	yellow	yellow

9 The diagram shows the structure of an ionic compound.



What is a possible formula for this compound?

A CaF_2 **B** $NaCl$ **C** SO_2 **D** MgO

10 18 g of water contains the same number of molecules as

A 18 g of ammonia gas.

B 2 g of hydrogen gas.

C 14 g of nitrogen gas.

D 16 g of oxygen gas.

11 The complete combustion of 20 cm^3 of a gaseous alkane, **X**, requires 130 cm^3 of oxygen. Both volumes were measured at r.t.p..

What could be the identity of **X**?

A butane

B ethane

C methane

D propane

12 Which process will separate an ionic compound *PQ* into its elements *P* and *Q*?

A distillation

B electrolysis

C filtration

D precipitation

13 Which statement describes the conversion of magnesium atoms to magnesium ions?

A The change is reduction, because there has been a gain of electrons.

B The change is oxidation, because there has been a loss of electrons.

C The change is reduction, because there has been a loss of electrons.

D The change is oxidation, because there has been a gain of electrons.

14 Which arrangement would be used to electroplate copper onto a steel key?

	electrolyte	anode (positive electrode)	cathode (negative electrode)
A	aqueous copper(II) sulfate	piece of pure copper	steel key
B	aqueous copper(II) sulfate	steel key	piece of pure copper
C	aqueous sulfuric acid	piece of pure copper	steel key
D	aqueous sulfuric acid	steel key	piece of pure copper

15 Sodium hydrogencarbonate decomposes on heating.

$$2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$$

In an experiment, a 5.0 mol sample of sodium hydrogencarbonate is heated.

Which volume of carbon dioxide, measured at room temperature and pressure, is evolved?

A $24\,dm^3$ **B** $36\,dm^3$ **C** $48\,dm^3$ **D** $60\,dm^3$

16 It has been suggested that the cars of the future could be powered by fuel cells. One type of fuel cell uses the chemical reaction between oxygen and hydrogen to produce electricity.

What would be a disadvantage of using this type of fuel cell to power a car?

A A car cannot be powered by electricity.

B The hydrogen tank might split in an accident, leading to an explosion.

C The product of the reaction between oxygen and hydrogen is toxic.

D The oxygen would need to be obtained from air.

17 Sulfur and selenium, Se, are in the same group of the Periodic Table.

From this, we would expect selenium to form compounds having the formulae

A Se_2O, Na_2Se and $NaSeO_4$.

B SeO_2, Na_2Se and $NaSeO_4$.

C SeO_2, Na_2Se and Na_2SeO_4.

D SeO_3, NaSe and $NaSeO_4$.

18 When the product of a reaction between two gases is added to water, a solution of pH7 is formed.

Which could be these gases?

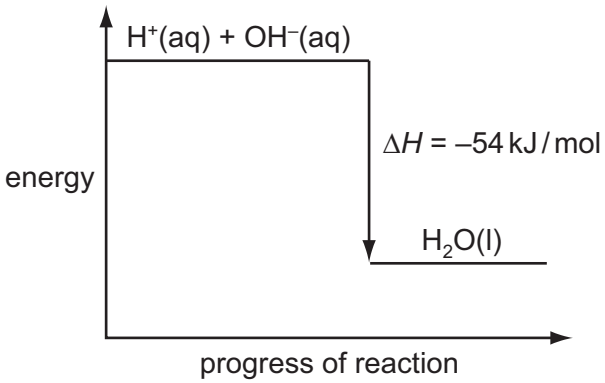
A hydrogen and chlorine

B hydrogen and nitrogen

C hydrogen and oxygen

D oxygen and carbon monoxide

19 The energy diagram for the reaction between aqueous sodium hydroxide and dilute hydrochloric acid is shown.



What can be deduced from the diagram?

A The energy change when one mole of water is formed from its elements, hydrogen and oxygen, is 54 kJ / mol.

B The OH^- ions have more energy than the H^+ ions.

C The products contain less energy than the reactants.

D The reaction is endothermic.

20 Which change will **not** increase the rate of a chemical reaction?

A an increase in concentration of aqueous reactants

B an increase in pressure of gaseous reactants

C an increase in temperature of a reaction system

D an increase in the particle size of solid reactants

21 The metals iron, lead and zinc can be manufactured by the reduction of their oxides with coke.

What is the correct order of the ease of reduction of the metal oxides?

	oxides become more difficult to reduce ⟶
A	iron → lead → zinc
B	iron → zinc → lead
C	lead → iron → zinc
D	zinc → iron → lead

22 The following stages happen during eutrophication.

1 increase in growth of algae

2 increase in nitrate concentration

3 death of aquatic plants

4 decrease in dissolved oxygen

In which order do these stages occur?

A 1 → 2 → 3 → 4

B 1 → 2 → 4 → 3

C 2 → 1 → 3 → 4

D 2 → 1 → 4 → 3

23 The equation shows that mixtures of hydrogen gas and iodine vapour can reach equilibrium.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

Two students, X and Y, make statements about the equilibrium mixture.

X Hydrogen iodide is continually being formed and decomposed.

Y If more hydrogen is injected into the equilibrium mixture the equilibrium concentration of HI increases.

Which statements are correct?

A both X and Y

B X only

C Y only

D neither X nor Y

24 Aluminium is manufactured by the electrolysis of molten aluminium oxide.

Which gas is **not** formed during this process?

A carbon dioxide

B carbon monoxide

C oxygen

D sulfur dioxide

25 Which equation represents a redox reaction?

A $4CuO + CH_4 \rightarrow 4Cu + 2H_2O + CO_2$

B $CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$

C $CuCO_3 \rightarrow CuO + CO_2$

D $CuSO_4 + 2NaOH \rightarrow Cu(OH)_2 + Na_2SO_4$

26 What is the percentage, by mass, of nitrogen in the fertiliser $(NH_4)_3PO_4$?
[A_r: H, 1; N, 14; O, 16; P, 31]

A 9.4% **B** 18.8% **C** 28.2% **D** 37.6%

27 In the Contact process for the manufacture of sulfuric acid, the most important reaction occurs in the catalyst chamber.

Which set of reactants and catalyst for this reaction is correct?

	reactants	catalyst
A	sulfur and oxygen	vanadium(V) oxide
B	sulfur dioxide and air	vanadium(V) oxide
C	sulfur dioxide and steam	iron
D	sulfur trioxide and water	platinum

28 Which compound is formed by a method involving precipitation?

A NaCl

B K_2SO_4

C $Ca(NO_3)_2$

D $PbSO_4$

29 Ionic compounds have high melting points because of the strong attraction between oppositely charged ions.

Which compound has the lowest melting point?

A $(Al^{3+})_2(O^{2-})_3$

B $Mg^{2+}O^{2-}$

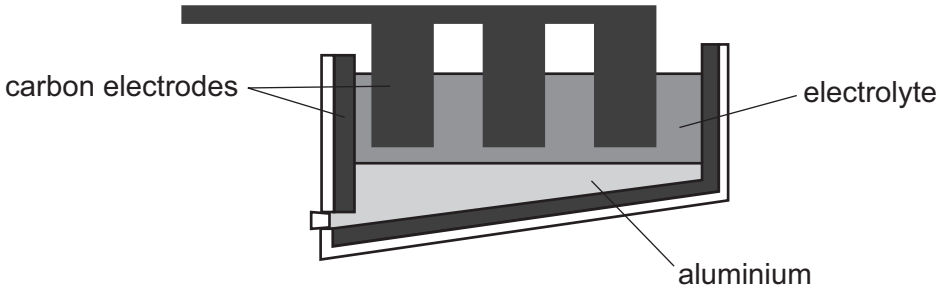
C $Na^{+}Cl^{-}$

D $(Fe^{3+})_2(O^{2-})_3$

30 In which row are the elements placed in the correct order of their chemical reactivity, starting with the most reactive element?

	most reactive ⟶		least reactive
A	calcium	magnesium	silver
B	magnesium	calcium	silver
C	silver	calcium	magnesium
D	silver	magnesium	calcium

31 The diagram shows the apparatus needed to extract aluminium from aluminium oxide.



Which statement about this process is correct?

A The electrolyte is a solid mixture of aluminium oxide and cryolite.

B The electrolyte is aluminium oxide dissolved in water.

C The equation for the reaction at the positive electrode is $Al^{3+} + 3e^- \rightarrow Al$.

D The positive carbon electrodes lose mass during the process and need regular replacement.

32 Graphite shares some properties with metals.

Which property of graphite is **not** one of the general properties of metals?

A Graphite forms a gaseous oxide.

B Graphite has a high melting point.

C Graphite is a conductor of electricity.

D Graphite is a solid.

33 Which metallic element, represented by *X*, has the following characteristics?

- It can be prevented from corroding by attaching a piece of magnesium to it.
- Two of its oxides have the formulae *X*O and X_2O_3.
- It has the highest percentage by mass of all the metals present in stainless steel.

A Fe **B** Na **C** Pb **D** Zn

34 Which pair of gases are both non-acidic?

A ammonia and methane

B carbon dioxide and ammonia

C methane and nitrogen dioxide

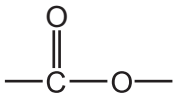
D nitrogen dioxide and carbon dioxide

35 Both nylon and the proteins found in egg yolk are polymers.

Which statement about nylon and these proteins is correct?

A They are both naturally occurring macromolecules.

B They are both polyamides.

C They both possess the  linkage.

D They can both be hydrolysed to form amino acids.

36 An organic compound has an empirical formula C_2H_4O.

What could the compound be?

A butanoic acid

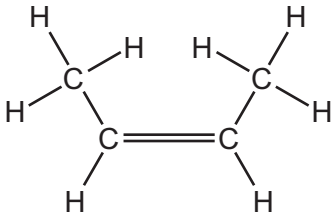
B butanol

C ethanoic acid

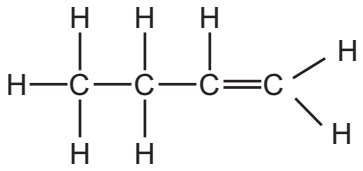
D ethanol

37 Which diagram shows the structure of the monomer of poly(propene)?

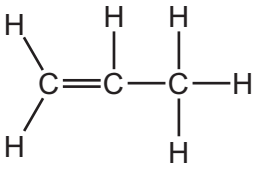
A



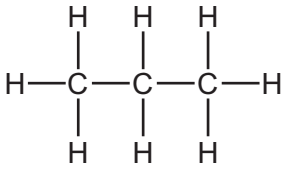
B



C



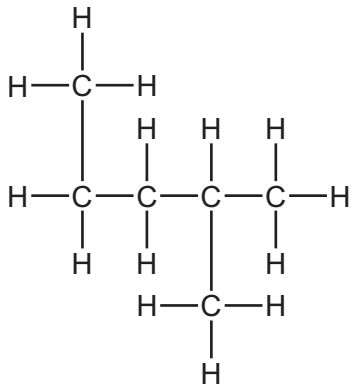
D



38 Alkanes are saturated compounds containing carbon and hydrogen only.

Structures 1, 2, 3 and 4 are saturated hydrocarbons.

1



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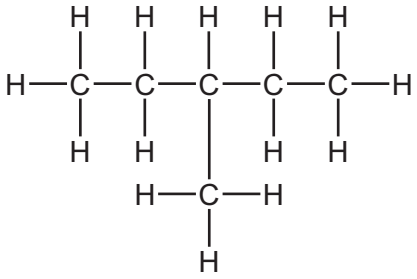

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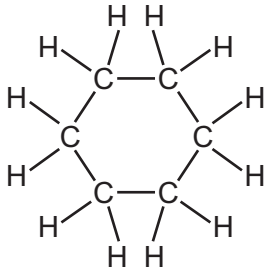

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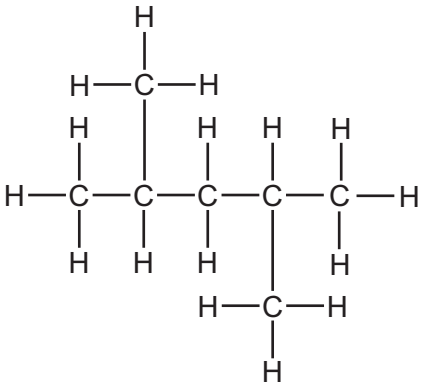


Which pair of structures are isomers?

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

39 Which pair of compounds are both esters and are isomers of each other?

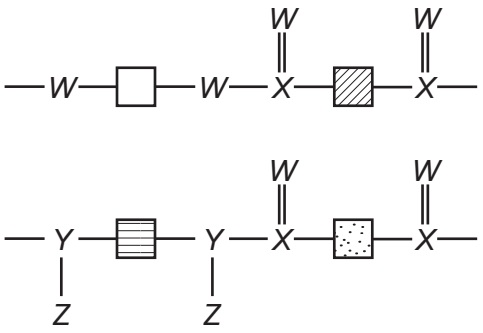
A HCO_2CH_3 and CH_3CO_2H

B $CH_3CO_2CH_3$ and $C_2H_5CO_2H$

C $CH_3CO_2C_2H_5$ and $C_2H_5CO_2CH_3$

D $C_3H_7CO_2CH_3$ and $CH_3CO_2C_2H_5$

40 The diagram shows the partial structures of two different polymers.



Which chemical symbols should replace *W*, *X*, *Y* and *Z*?

	W	*X*	*Y*	*Z*
A	C	N	H	O
B	O	C	H	N
C	O	C	N	H
D	N	H	O	C

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DATA SHEET
The Periodic Table of the Elements

Group																		
I	II										III	IV	V	VI	VII	0
																4 He Helium 2
				1 H Hydrogen 1							11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
7 Li Lithium 3	9 Be Beryllium 4										27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
23 Na Sodium 11	24 Mg Magnesium 12										70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	131 Xe Xenon 54
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	Rn Radon 86
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80				At Astatine 85	
	226 Ra Radium 88	227 Ac Actinium 89 †														

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

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