Class/ Index Number /	Centre Number/ 'O' Level Index Number /	Name

新加坡海星中学

MARIS STELLA HIGH SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR

CHEMISTRY **6092/01**

Paper 1 Multiple Choice **3 September 2025**

1 hour

Additional Materials:
Optical Test Answer Sheet (OTAS) – 1 sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your class, index number, Centre number, O level index number and name in the spaces at the top of this page.

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 answer in **soft pencil** on the separate Answer Sheet.

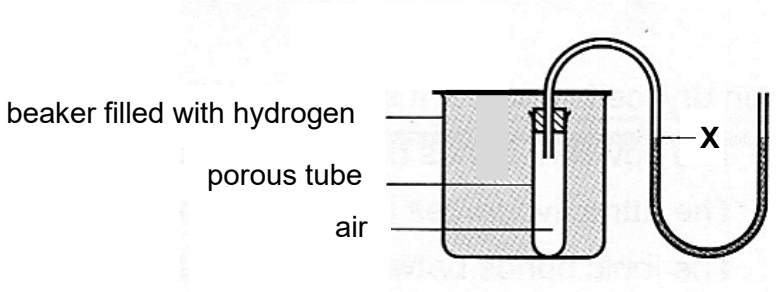
Read the instructions on the Answer Sheet very carefully.

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 question booklet.
A copy of the Periodic Table is printed on page 15.
The use of an approved scientific calculator is expected, where appropriate.

The total number of marks for this paper is 40.

At the end of the examination, hand in the following separately:
(1) Optical Test Answer Sheet (OTAS)
(2) Question Paper

1 The apparatus can be used to show the diffusion of gases. Air is present in the porous tube. The beaker is filled with hydrogen.
Assume all gases are at the same temperature and pressure.



What would happen to the water level at **X** over time?

A The water level at **X** will remain unchanged.

B The water level at **X** will drop and remains there.

C The water level at **X** will drop and then return to its original position.

D The water level at **X** will rise and then return to its original position.

2 The table shows some mixtures and their constituents are obtained using suitable separation techniques.

	mixture	constituent obtained
1	NaC*l*(aq)	H_2O(l)
2	I_2(s) and Ni(s)	I_2(s)
3	NaC*l*(aq)	NaC*l*(s)

Which row gives the correct separation techniques to obtain the constituents from the mixture?

	1	2	3
A	distillation	sublimation	evaporation
B	distillation	sublimation	filtration
C	filtration	crystallisation	evaporation
D	sublimation	crystallisation	filtration

3 An element, **Z**, has **p** protons and **n** neutrons in its nucleus.

Which row gives a possible correct number of protons, neutrons and electrons in a negative ion of an isotope of **Z**?

	protons	neutrons	electrons
A	**p**	**n**+1	**p**+1
B	**p**	**n**+1	**p**–1
C	**p**+1	**n**	**p**+1
D	**p**+1	**n**	**p**–1

4 The proton numbers of elements **X**, **Y** and **Z** are 6, 8 and 12 respectively.

Which row shows the correct formulae of the compounds formed between the elements?

	compound 1	compound 2	compound 3
A	Z_2Y	XY	ZXY_3
B	ZY	XY_2	ZXY_3
C	ZY	XY_2	ZXY_4
D	Z_2Y	XY	ZXY_4

5 The formation of metallic oxides involves the transfer of electrons from a metal atom to oxygen atoms.

In the formation of one mole of metallic oxide, which oxide involves the transfer of more than 2 moles of electrons from metal atoms?

A aluminium oxide

B iron(II) oxide

C magnesium oxide

D sodium oxide

6 Which substance contains atoms bonded to other atoms by less than four covalent bonds?

A diamond

B poly(ethene)

C silicon dioxide

D water

7 Solid copper metal, aqueous copper(II) sulfate, solid graphite and molten magnesium chloride will conduct electricity.

Which pair of substance will conduct electricity because they both contain mobile electrons?

A aqueous copper(II) sulfate and molten magnesium chloride

B aqueous copper(II) sulfate and solid copper metal

C molten magnesium chloride and solid graphite

D solid copper metal and solid graphite

8 Which of the statements about iron(III) oxide, Fe_2O_3, are correct?

1 Iron is present in Fe_2O_3 as an Fe^{2+} ion.

2 One mole of Fe_2O_3 contains 112 g of iron and 48 g of oxygen.

3 The empirical formula is Fe_2O_3.

4 Three moles of oxygen molecules are needed to make one mole of Fe_2O_3.

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

9 Ammonium nitrate, NH_4NO_3, (M_r = 80) decomposes to form dinitrogen oxide and water upon heating as shown in the equation below.

$$NH_4NO_3 \rightarrow N_2O + 2H_2O$$

When an impure sample of ammonium nitrate is heated, 27 g of water is formed.

Which expression shows the mass of ammonium nitrate in the impure sample?

A $66 \times \frac{27}{36}$

B $80 \times \frac{27}{36}$

C $80 \times \frac{27}{18}$

D $80 \times \frac{9}{36}$

10 20 cm^3 of propene ,C_3H_6, reacts with 500 cm^3 of oxygen according to the equation shown below.

$$2C_3H_6\ (g)\ +\ 9O_2\ (g)\ \rightarrow\ 6CO_2\ (g)\ +\ 6H_2O\ (g)$$

When cooled to room temperature, what is the total volume of gas remaining at the end of the reaction?

A 120 cm^3

B 410 cm^3

C 470 cm^3

D 530 cm^3

11 Which method(s) is/are suitable to distingush between 1.00 mol/dm^3 of aqueous hydrochloric acid and 1.00 mol/dm^3 of aqueous ethanoic acid?

1 using a pH meter

2 determining the volume of 1.00 mol/dm^3 of sodium hydroxide solution used to neutralise 25.0 cm^3 of the acids separately

3 measuring the total volume of hydrogen gas formed when excess magnesium is added to the acids separately

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

12 The table shows the properties of four chlorides.

Which is copper(II) chloride?

	colour	**solubility in water**	**method of preparation**
A	green	soluble	copper(II) oxide and hydrochloric acid
B	green	insoluble	copper metal and hydrochloric acid
C	white	insoluble	sodium chloride and copper(II) sulfate
D	green	soluble	copper(II) nitrate and hydrochloric acid

13 The following reactions are carried out.

reaction	result
ethanoic acid is added to ammonium carbonate	Gas **E** is produced.
ammonium ethanoate is warmed with sodium hydroxide solution	Gas **F** is produced.
ethanoic acid is added to an aqueous solution of ammonia	Compound **G** is formed.

What are gases **E**, **F** and compound **G**?

	gas **E**	gas **F**	compound **G**
A	ammonia	ammonia	ammonium carbonate
B	ammonia	carbon dioxide	ammonium ethanoate
C	carbon dioxide	carbon dioxide	ammonium carbonate
D	carbon dioxide	ammonia	ammonium ethanoate

14 Which equation shows a non-redox reaction?

A $2H_2 + O_2 \rightarrow 2H_2O$

B $Fe^{2+} \rightarrow Fe^{3+} + e^-$

C $2H^+ + CO_3^{2-} \rightarrow H_2O + CO_2$

D $CuO + H_2 \rightarrow Cu + H_2O$

15 The reaction between copper and concentrated nitric acid is shown below.

$$Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2H_2O + 2NO_2$$

Which statement about this reaction is correct?

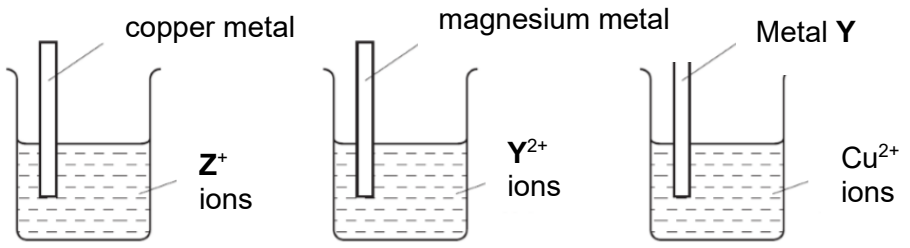
A HNO_3 is a reducing agent.

B The oxidation state of nitrogen in $Cu(NO_3)_2$ is -5.

C Cu loses electrons during the reaction.

D The oxidation state of oxygen has changed.

16 A student conducted three experiments to compare the reactivities of four different metals; copper, magnesium, metal **Y** and metal **Z**.



A deposit was observed on the metal strip for each experiment.

How many metals that were investigated will be able to react with aqueous hydrochloric acid?

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

17 Hydrogen is produced by the reaction of a metal **A** and a dilute acid.

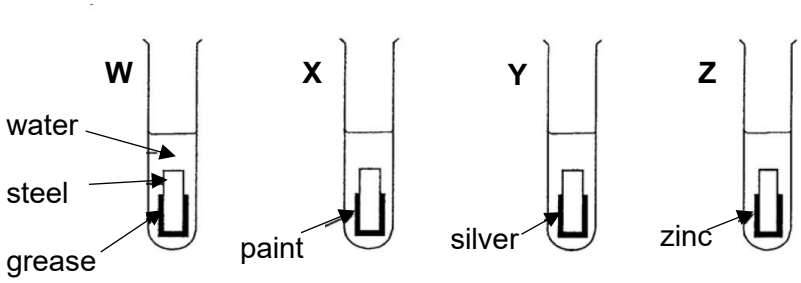
When the same gas is passed over an oxide of metal **B**, it reduced the metallic oxide to its metal in the presence of heat.

Which substances would give these results?

	metal **A**	dilute acid	metal **B**
1	calcium	hydrochloric acid	lead(II) oxide
2	copper	hydrochloric acid	silver oxide
3	iron	sulfuric acid	copper(II) oxide
4	zinc	sulfuric acid	calcium oxide

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

18 Four identical pieces of steel were partially coated with four different substances as shown below. The steel pieces were then left in test tubes filled with water for some days.



In which tube would the steel be least likely to rust?

A test tube **W**

B test tube **X**

C test test **Y**

D test tube **Z**

19 A newly discovered alkali metal, **Q**, has an atomic number greater than 37.

What is the most likely property of **Q**?

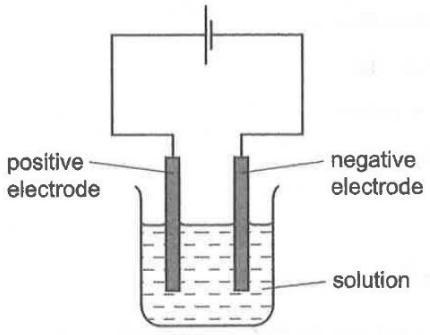
A **Q** floats on water.

B **Q** has a higher melting point than sodium.

C **Q** reacts with chlorine gas to form a yellow crystalline solid.

D **Q** reacts with water more vigorously than potassium with water.

20 Four different solutions were electrolysed in separate experiments.



Which electrolytic set-up results in no change in the concentration of the solution during electrolysis.?

A aqueous sodium chloride solution with carbon electrodes

B copper(II) sulfate solution with copper electrodes

C copper(II) sulfate solution with platinum electrodes

D dilute sodium chloride solution with platinum electrodes

21 In an electrolysis, the same amount of charge deposited 54.0 g of silver and 14.9 g of tin.

The charge on the silver ion is 1+.

What was the charge of the tin ion?

A 1+

B 2+

C 3+

D 4+

22 Which statement describes what happens when hydrogen and oxygen are used in a fuel cell?

A Electricity is generated due to flow of electrons from cathode to anode.

B Hydrogen is reduced by losing electrons at the anode.

C Oxygen is oxidised by gaining electrons at the cathode.

D Water is produced as the only product in the overall equation.

23 Which statement about the elements in Period 3 going from left to right of the Periodic Table is correct?

A The metallic properties of the elements increases.

B The nature of the elements changes from strong reducing agents to strong oxidising agents.

C The nature of the oxides of the elements changes from acidic to basic.

D The tendency of the elements to lose electrons increases.

24 Tellurium (Te) and sulfur belong to Group 16 of the Periodic Table.

What could be the likely formula of a compound of tellurium?

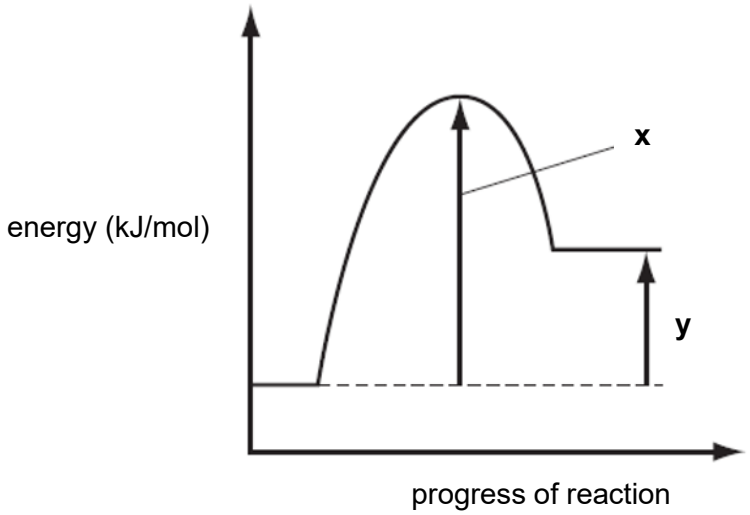
A H_2Te

B $HTeO_3$

C TeN

D TeO

25 The energy profile diagram for a chemical reaction is shown below.



Which statement about the energy profile diagram is correct?

A The overall enthalpy change is equal to **x** + **y**.

B The reaction is exothermic.

C The value of **x** would decrease in the presence of a catalyst.

D The value of **y** would increase in the presence of a catalyst.

26 The scheme shows four stages, 1 to 4, in the conversion of solid candlewax, $C_{30}H_{62}$, into carbon dioxide and water

1 $C_{30}H_{62}(s) \rightarrow C_{30}H_{62}(l)$

2 $C_{30}H_{62}(l) \rightarrow C_{30}H_{62}(g)$

3 $2C_{30}H_{62}(g) + 91O_2(g) \rightarrow 60CO_2(g) + 62H_2O(g)$

4 $30CO_2(g) + 31H_2O(g) \rightarrow 30CO_2(g) + 31H_2O(l)$

Which stages are exothermic?

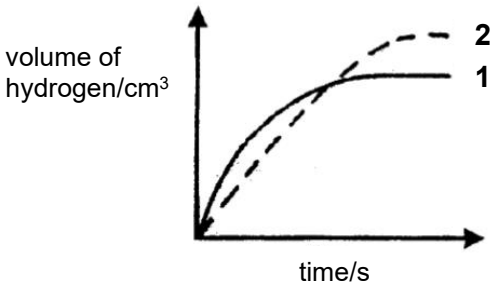
A 1 and 2

B 1 and 4

C 2 and 3

D 3 and 4

27 In the graph below, curve **1** was obtained by the reaction between 50.0 cm^3 of 1.0 mol/dm^3 sulfuric acid and excess zinc granules.



Which changes would produce curve **2**?

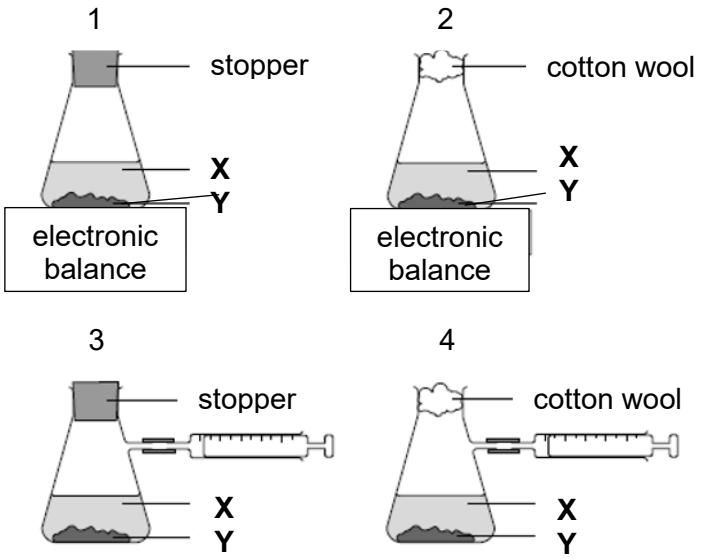
A Add the same mass of zinc powder instead of zinc granules.

B Increase the temperature by 10°C.

C Use 100.0 cm^3 of 0.75 mol/dm^3 sulfuric acid.

D Use 100.0 cm^3 of 1.00 mol/dm^3 sulfuric acid.

28 A liquid **X** reacts with solid **Y** to form a gas.



Which two diagrams show suitable methods for investigating the rate of the reaction?

A 1 and 3

B 1 and 4

C 2 and 3

D 2 and 4

29 Ammonia is produced by the Haber process.

Which statement is **not** correct?

A An iron catalyst is used.

B Each hydrogen molecule reacts with three nitrogen molecules to form two molecules of ammonia.

C Hydrogen for the Haber process can be obtained by the cracking of crude oil.

D The reaction is reversible.

30 Which statement about the properties of ammonia is correct?

A It is formed upon heating solid ammonium chloride.

B It dissolves in water to form a solution with pH less than 7.

C It is formed by reacting ammonium salts with nitric acid.

D It reacts with alkali to form salts.

31 A sample of air is bubbled through sodium hydroxide, then passed over heated copper.

Which gases are removed by this process?

A carbon dioxide and oxygen

B carbon dioxide and water vapour

C hydrogen and nitrogen

D nitrogen and oxygen

32 Which pair of gases can cause the most damage to limestone buildings?

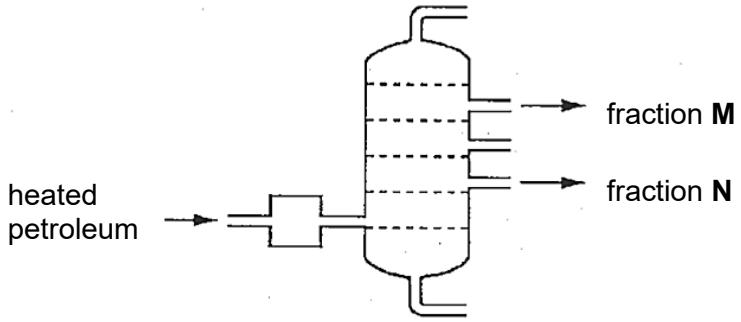
A CO and NO

B NO and CH_4

C SO_2 and CO

D SO_2 and NO_2

33 The diagram shows the fractional distillation of petroleum.



Which row about fractions **M** and **N** are correct?

	M burns more easily than **N**	**M** has a higher boiling point than **N**	**M** is more viscous than **N**
A	True	False	False
B	True	True	True
C	False	True	False
D	False	False	True

34 In the polymerisation of ethene to form poly(ethene), which property remains constant?

A boiling point

B density

C empirical formula

D molecular mass

35 Under certain conditions, 1 mole of ethane reacts with 2 moles of chlorine in a substitution reaction.

What is the formula of the organic product in this reaction?

A C_2H_5Cl

B $C_2H_4Cl_2$

C $C_2H_2Cl_4$

D CH_2Cl_2

36 Olive oil contains oleic acid. Oleic acid is an unsaturated acid which has molecular formula $C_{17}H_{31}COOH$.

How many carbon–carbon double bonds are present in one molecule of oleic acid?

A 1

B 2

C 3

D 4

37 The following statements describe an organic compound, **L**.

1 It reacts with sodium carbonate to produce a colourless gas.

2 It decolourises bromine solution.

3 If a mixture of ethanoic acid and compound **L** is warmed with concentrated sulfuric acid, no sweet smelling substance is formed.

What could be the molecular formula of compound **L**?

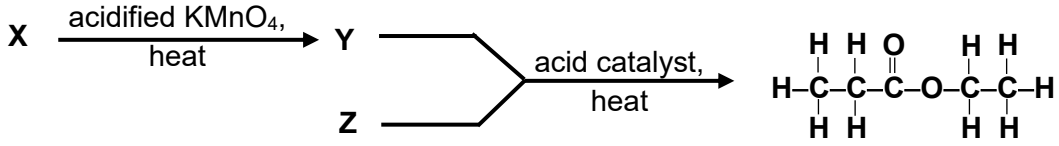
A CH=CHCOOH

B CH_2=CHCOOCH_3

C $CH_3CH_2CH_2OH$

D $CH_3CH_2CH_2C\mathit{l}$

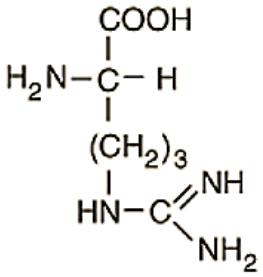
38 The following reaction scheme shows the reactions of three substances, **X**, **Y** and **Z**.



What are the molecular formulae of substances **X**, **Y** and **Z**?

	X	Y	Z
A	C_2H_6O	$C_3H_6O_2$	C_2H_6O
B	C_3H_6	C_3H_8O	$C_2H_5O_2$
C	C_3H_8O	$C_3H_6O_2$	C_2H_6O
D	C_3H_8O	$C_4H_8O_2$	C_2H_6O

39 The full structural formula of the amino acid, Arginine, is shown below.



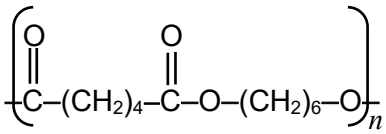
The following statements were made about the amino acid.

1 It undergoes addition polymerisation.
2 It forms a polymer with the same linkage as nylon.
3 It reacts with magnesium to form hydrogen gas.
4 It decolorises acidified potassium manganate(VII) solution readily.

Which statements are correct?

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

40 Some polymers can undergo depolymerisation through acid hydrolysis.



Which of the following represents the monomers of the above polymer?

A $HO–(CH_2)_4–OH$ and $HO–(CH_2)_6–OH$
B $HOOC–(CH_2)_6–COOH$ and $HO–(CH_2)_4–OH$
C $HOOC–(CH_2)_4–OH$ and $HO–(CH_2)_6–COOH$
D $HOOC–(CH_2)_4–COOH$ and $HO–(CH_2)_6–OH$

End of Paper

The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
							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	3	4	5	6	7	8	9	10	11	12	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 –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

Key

proton (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.).
The Avogadro constant, L = 6.02 x 10^{23} mol^{-}