Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/23**

Paper 2 Multiple Choice (Extended) **May/June 2019**

45 minutes

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

2518966734

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.

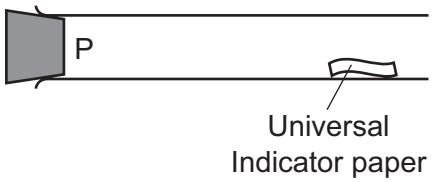
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This document consists of **15** printed pages and **1** blank page.

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1 Hydrogen chloride gas (M_r = 36.5) is released at P in the apparatus shown.

The Universal Indicator paper turns red after 38 s.



The experiment is repeated using sulfur dioxide (M_r = 64).

What is the result for sulfur dioxide?

	Universal Indicator turns	time for Universal Indicator to change colour / s
A	blue	26
B	blue	51
C	red	26
D	red	51

2 Which piece of apparatus is used to measure 24.8 cm^3 of gas produced during a reaction?

A beaker

B conical flask

C measuring cylinder

D pipette

3 R_f values are used to identify unknown substances using paper chromatography.

Which statements about R_f values are correct?

1 R_f values are always less than 1.0.

2 R_f value = distance travelled by solvent ÷ distance travelled by unknown substance.

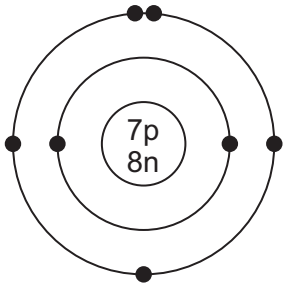
3 The higher the R_f value, the further the unknown substance travels.

4 R_f values are not affected by the solubility of the unknown substance.

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

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4 The structure of an atom is shown.



key
● = electron
n = neutron
p = proton

Which element is the atom an isotope of?

A nitrogen

B oxygen

C phosphorus

D titanium

5 Which row describes the formation of single covalent bonds in methane?

A	atoms share a pair of electrons	both atoms gain a noble gas electronic structure
B	atoms share a pair of electrons	both atoms have the same number of electrons in their outer shell
C	electrons are transferred from one atom to another	both atoms gain a noble gas electronic structure
D	electrons are transferred from one atom to another	both atoms have the same number of electrons in their outer shell

6 Which statement describes the structure of an ionic compound?

A It is a giant lattice of oppositely charged ions.

B It is a giant lattice of positive ions in a ‘sea’ of electrons.

C It is a giant molecule of oppositely charged ions.

D It is a simple molecule of oppositely charged ions.

7 When propane burns in air, carbon dioxide and water are formed.

What is the chemical equation for this reaction?

A $C_3H_8 + 2O_2 \rightarrow CO_2 + 2H_2O$

B $C_3H_8 + 3O_2 \rightarrow 3CO_2 + H_2O$

C $C_3H_8 + 4O_2 \rightarrow 3CO_2 + 4H_2O$

D $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

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8 What is the concentration of a solution that contains 25.0 g NaOH in 500 cm^3 of water?

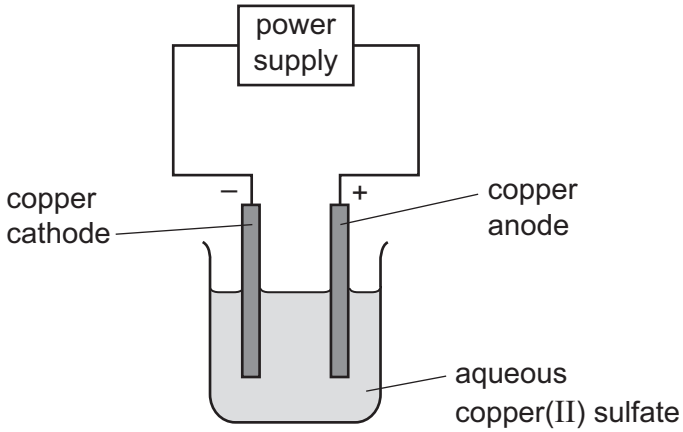
A 0.125 mol / dm^3

B 0.800 mol / dm^3

C 1.25 mol / dm^3

D 3.20 mol / dm^3

9 An aqueous solution of copper(II) sulfate was electrolysed using copper electrodes.



Which equation for the reaction at the anode is correct?

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

B $Cu + 2e^- \rightarrow Cu^{2+}$

C $Cu^{2+} \rightarrow Cu + 2e^-$

D $Cu^{2+} + 2e^- \rightarrow Cu$

10 In the manufacture of aluminium by electrolysis, aluminium oxide is dissolved in molten cryolite.

Why is cryolite used?

A It lowers the melting point of the aluminium.

B It makes the aluminium a better conductor.

C It removes impurities from the aluminium.

D The mixture has a lower melting point than pure aluminium oxide.

11 Which statement about a fuel cell in a car is correct?

A The fuel cell produces heat, which powers the car.

B The fuel cell is supplied with hydrogen directly from the air.

C The only emission from a fuel cell is nitrogen gas, which is non-polluting.

D The fuel cell produces electricity, which powers an electric motor.

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12 Methane burns in oxygen to form carbon dioxide and water.

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

The bond energies are shown in the table.

bond	bond energy in kJ / mol
C–H	410
C–O	360
C=O	805
O–H	460
O–O	146
O=O	496

What is the energy change for this reaction?

A –818 kJ / mol **B** –102 kJ / mol **C** +102 kJ / mol **D** +818 kJ / mol

13 Which change in reaction conditions increases both the collision rate and the proportion of molecules with sufficient energy to react?

A addition of a catalyst

B increasing the concentration of a reactant

C increasing the surface area of a reactant

D increasing the temperature of the reaction

14 When blue-green crystals of nickel(II) sulfate are heated, water is produced and a yellow solid remains. When water is added to the yellow solid, the blue-green colour returns.

Which process describes these changes?

A combustion

B corrosion

C neutralisation

D reversible reaction

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15 A reaction between nitrogen and oxygen is shown. The forward reaction is endothermic.

$$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$$

Which change increases the equilibrium yield of nitrogen monoxide, NO?

A decreasing the pressure

B decreasing the temperature

C increasing the pressure

D increasing the temperature

16 Which changes represent reduction?

1 $Cl_2 + 2e^- \rightarrow 2Cl^-$

2 $Mn(VII) \rightarrow Mn(II)$

3 $sulfate(IV) \rightarrow sulfate(VI)$

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

17 Which statement about carbon monoxide and aluminium oxide is correct?

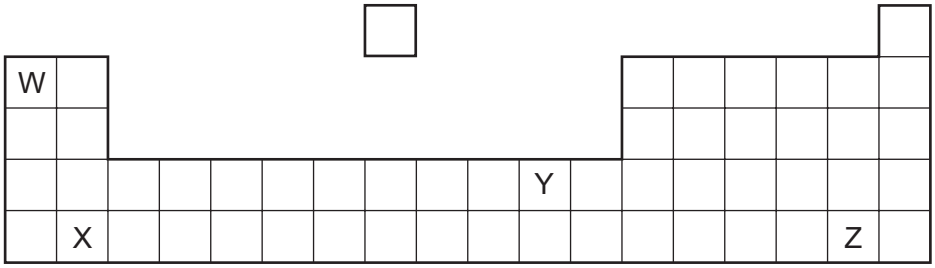
A Carbon monoxide and aluminium oxide are both amphoteric.

B Carbon monoxide and aluminium oxide are both neutral.

C Carbon monoxide is amphoteric but aluminium oxide is neutral.

D Carbon monoxide is neutral but aluminium oxide is amphoteric.

18 The positions of elements W, X, Y and Z in the Periodic Table are shown.



Which elements form basic oxides?

A W, X and Y **B** W and X only **C** Y only **D** Z only

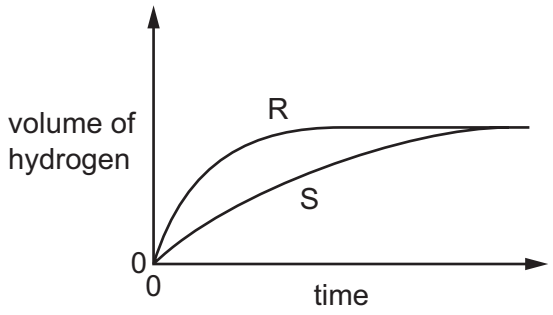
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19 Solutions of acid R and acid S have the same concentration.

The same volume of each acid at the same temperature is reacted with the same mass of magnesium ribbon.

The volume of hydrogen produced is measured.

The results are shown.



Which statement about the reactions is correct?

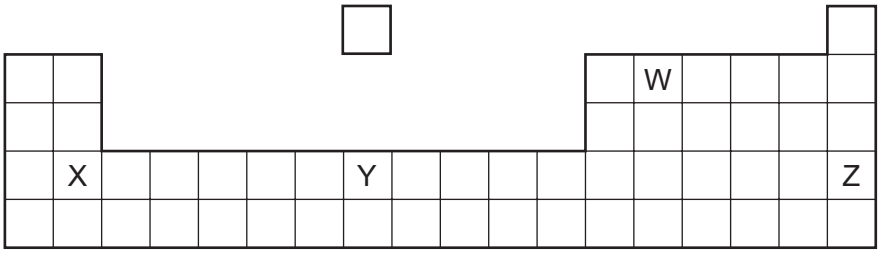
A Acid S reacts faster than acid R.

B The final volume of hydrogen produced in each reaction is different.

C Acid R is a stronger acid than acid S.

D Acid S is a stronger acid than acid R.

20 Part of the Periodic Table is shown.



Which row describes W, X, Y and Z?

	metal	non-metal
A	X	W, Y and Z
B	X and Y	W and Z
C	W and Z	X and Y
D	W, Y and Z	X

21 Which statement about the properties of elements in Group I and in Group VII is correct?

A Bromine displaces iodine from an aqueous solution of potassium iodide.

B Chlorine, bromine and iodine are diatomic gases at room temperature.

C Lithium, sodium and potassium are soft non-metals.

D Lithium, sodium and potassium have an increasing number of electrons in their outer shells.

22 Gas G has 10 electrons. Gas H has eight more electrons than gas G. Both gases are monoatomic.

Which statement about G and H is correct?

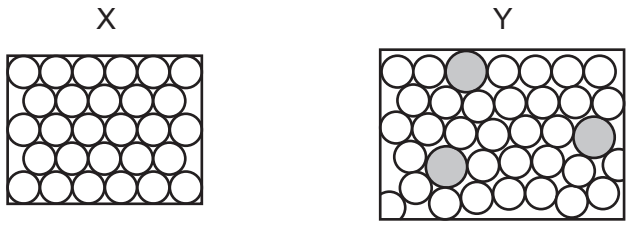
A Both gases are in the same group of the Periodic Table.

B Both gases are in the same period of the Periodic Table.

C Both gases are very reactive.

D Gas G has a higher atomic mass than gas H.

23 The diagrams show the structure of two substances used to make electrical conductors.



Which statement correctly describes X and Y?

A X is a pure metal and Y is a compound.

B X is a pure metal and Y is an alloy.

C X is a solid and Y is a liquid.

D X is harder and stronger than Y.

24 Magnesium nitrate, magnesium hydroxide and magnesium carbonate all decompose when heated.

Which statement about these decomposition reactions is correct?

A Magnesium carbonate decomposes to release carbon dioxide and oxygen.

B Magnesium hydroxide decomposes to release hydrogen and oxygen.

C Magnesium hydroxide decomposes to release water vapour.

D Magnesium nitrate decomposes to release oxygen only.

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25 Zinc is extracted from its ore, zinc blende, using two chemical reactions.

1 $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

2 $2ZnO + C \rightarrow 2Zn + CO_2$

Which substance is reduced in reactions 1 and 2?

	reaction 1	reaction 2
A	O_2	C
B	O_2	ZnO
C	ZnS	C
D	ZnS	ZnO

26 Four metals, zinc, M, copper and magnesium, are reacted with aqueous solutions of their nitrates.

The results are shown.

metal	magnesium nitrate	M nitrate	copper nitrate	zinc nitrate
magnesium		✓	✓	✓
zinc	✗	✓	✓	
M	✗		✓	✗
copper	✗	✗		✗

key

✓ = reacts

✗ = no reaction

What is the order of reactivity of these four metals starting with the most reactive?

A copper → zinc → M → magnesium

B copper → M → zinc → magnesium

C magnesium → M → zinc → copper

D magnesium → zinc → M → copper

27 Aluminium is used to make containers for storing food.

Which property makes it suitable for this use?

A conducts heat

B low density

C resists corrosion

D shiny surface

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[Turn over

28 Water can be treated by filtration then chlorination.

Which uses do **not** need water of this quality?

1 water for cooling in industry

2 water for washing clothes

3 water for drinking

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

29 Catalytic converters in car exhausts change polluting gases into non-polluting gases.

Which statements about oxides of nitrogen and car engines are correct?

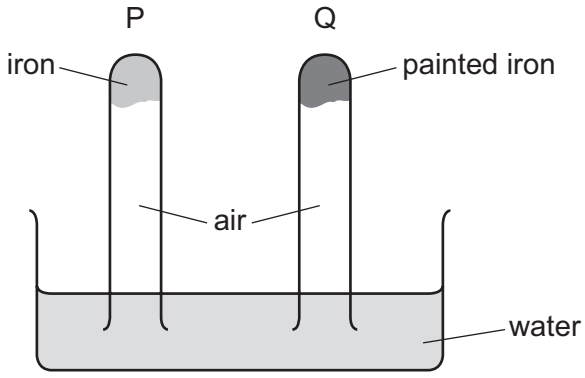
1 The nitrogen in oxides of nitrogen comes from compounds in petrol.

2 The oxygen in oxides of nitrogen comes from the air in the car engine.

3 Catalytic converters convert oxides of nitrogen into nitrogen and other gases.

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

30 The diagram shows an experiment to investigate how paint affects the rusting of iron.



What happens to the water level in tubes P and Q?

	tube P	tube Q
A	falls	rises
B	no change	rises
C	rises	falls
D	rises	no change

31 Which row about the carbon cycle is correct?

	process for removing carbon dioxide from the atmosphere	process for returning carbon dioxide to the atmosphere
A	photosynthesis	combustion of hydrocarbons
B	photosynthesis	cracking of hydrocarbons
C	respiration	combustion of hydrocarbons
D	respiration	cracking of hydrocarbons

32 Ammonia is manufactured in an exothermic reaction.

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

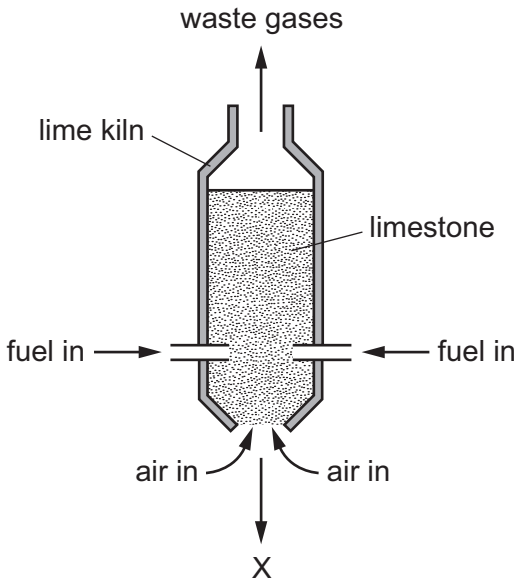
What is the effect of lowering the temperature on the rate of formation and equilibrium yield of ammonia?

	rate of formation	equilibrium yield
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

33 Which row shows the conditions used in the Contact process?

	temperature / °C	pressure / atm	catalyst
A	25	2	iron
B	25	200	iron
C	450	2	vanadium(V) oxide
D	450	200	vanadium(V) oxide

34 The diagram represents a lime kiln used to heat limestone to a very high temperature.



What leaves the kiln at X?

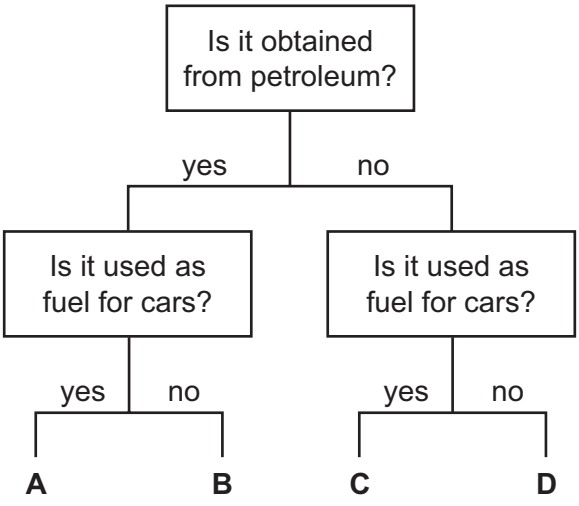
A calcium carbonate

B calcium hydroxide

C calcium oxide

D calcium sulfate

35 Which fuel could be gasoline?



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36 Which statements about homologous series are correct?

1 All members have similar chemical properties.

2 All members have the same molecular mass.

3 Ethane and ethene are members of the same homologous series.

4 Ethane and propane are members of the same homologous series.

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

37 Which type of reaction takes place when methane reacts with chlorine in the presence of ultraviolet light?

A addition

B cracking

C polymerisation

D substitution

38 Which statement about aqueous ethanoic acid is correct?

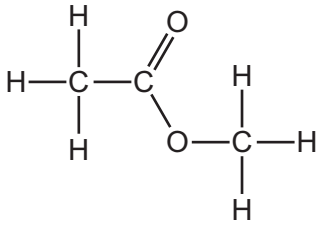
A It reacts with metal carbonates to form salts, hydrogen and water.

B It reacts with metal oxides to form salts and oxygen.

C It reacts with reactive metals to form salts and hydrogen.

D It turns damp red litmus paper blue.

39 The structure of ester W is shown.

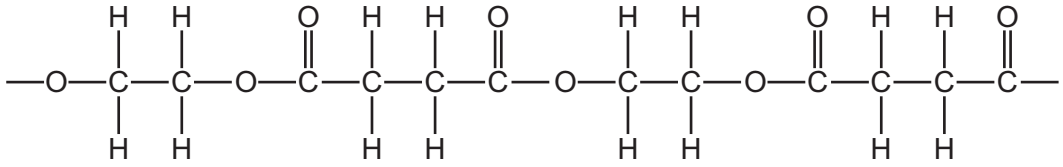


Which row gives the names of ester W and the carboxylic acid and alcohol from which it is made?

	name of ester W	carboxylic acid	alcohol
A	ethyl methanoate	ethanoic acid	methanol
B	ethyl methanoate	methanoic acid	ethanol
C	methyl ethanoate	ethanoic acid	methanol
D	methyl ethanoate	methanoic acid	ethanol

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40 A section of a polymer is shown.



How many different types of monomer units formed this section of polymer?

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

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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.).