Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/22**

Paper 2 Multiple Choice (Extended) **October/November 2017**

45 minutes

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

* 4 9 5 1 8 4 7 2 6 *

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.

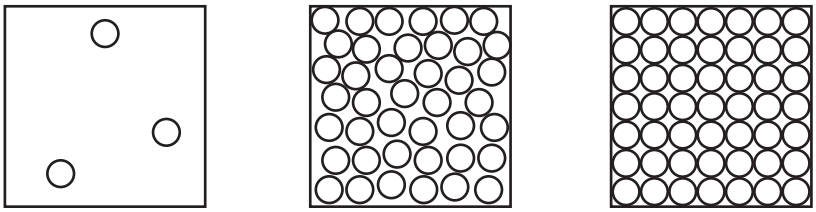
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 16.
Electronic calculators may be used.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **14** printed pages and **2** blank pages.

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1 The diagram shows the arrangement of particles in the three states of matter.



P Q R

Solid carbon dioxide (dry ice) sublimes to gaseous carbon dioxide.

Which row describes the initial and final states?

	initial state	final state
A	P	R
B	Q	P
C	R	P
D	R	Q

2 During an experiment a measurement is recorded in cm^3.

Which apparatus is used?

A balance

B measuring cylinder

C stopclock

D thermometer

3 A student carried out paper chromatography on a mixture of amino acids.

The student sprayed the dried chromatogram with a locating agent.

What is the function of the locating agent?

A to dissolve the amino acids

B to form coloured spots with the amino acids

C to preserve the amino acids

D to stop the amino acids reacting

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4 Which row describes silicon(IV) oxide?

	has a giant structure	is an acidic oxide	conducts electricity
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✗
D	✗	✓	✓

5 Why do isotopes of the same element have the same chemical properties?

A They have the same nucleon number.

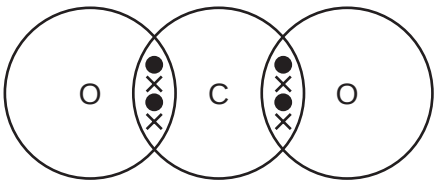
B They have the same number of electrons in the outer shell.

C They have the same number of neutrons in the nucleus.

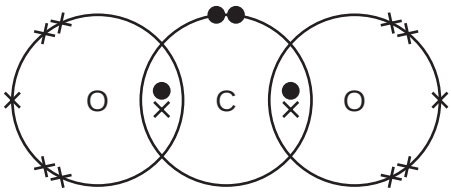
D They have the same number of protons as neutrons.

6 Which dot-and-cross diagram shows the outer shell electron arrangement in a molecule of carbon dioxide?

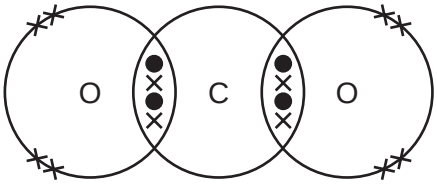
A



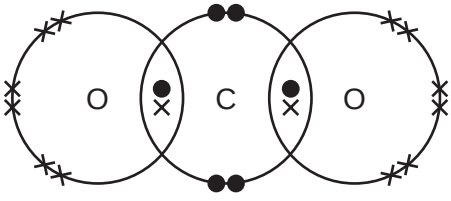
B



C



D



7 The equation for the reaction between phosphorus and oxygen is shown.

$$xP_4 + yO_2 \rightarrow zP_2O_5$$

Which values of *x*, *y* and *z* balance the equation?

	x	*y*	*z*
A	1	5	2
B	1	10	2
C	2	5	2
D	2	10	1

8 The relative molecular mass of an alcohol is 88.

Its percentage composition by mass is: C, 54.5%; H, 9.1%; O, 36.4%.

Which row shows the empirical formula and molecular formula for this alcohol?

	empirical formula	molecular formula
A	C_2H_4O	C_2H_4O
B	C_2H_4O	$C_4H_8O_2$
C	$C_4H_8O_2$	$C_4H_8O_2$
D	$C_4H_8O_2$	C_2H_4O

9 Which statements about the electrolysis of concentrated copper(II) chloride are correct?

1 Electrons are transferred from the cathode to the copper(II) ions.

2 Electrons move round the external circuit from the cathode to the anode.

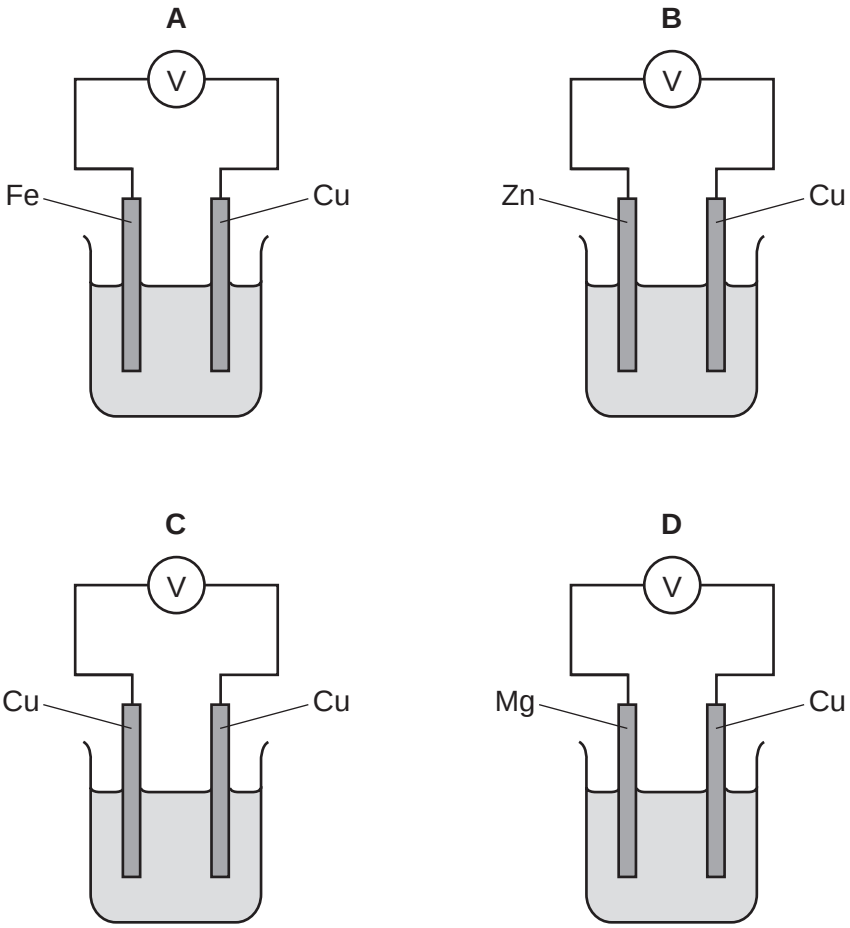
3 Chloride ions are attracted to the anode.

4 Hydroxide ions transfer electrons to the cathode.

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

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10 Which metal combination produces the highest voltage reading in the cells shown?



11 The equation for the combustion of methane is shown.

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

The energy change for the combustion of methane is –890 kJ / mol.

The bond energies are shown in the table.

bond	bond energy in kJ / mol
C–H	+410
O=O	+496
H–O	+460

What is the bond energy of the C=O bond?

A +49 kJ / mol **B** +841 kJ / mol **C** +1301 kJ / mol **D** +1335 kJ / mol

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[Turn over

12 Which statement describes an exothermic reaction?

A The energy absorbed for bond breaking is greater than the energy released by bond formation.

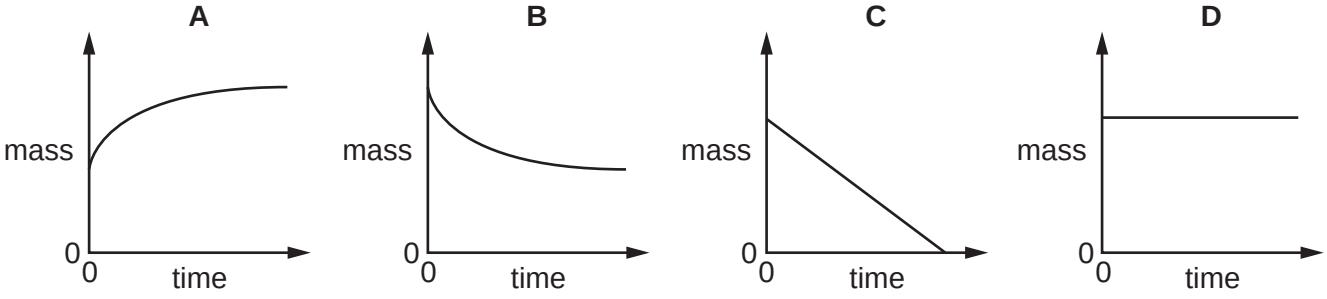
B The energy absorbed for bond breaking is less than the energy released by bond formation.

C The energy released by bond breaking is greater than the energy absorbed for bond formation.

D The energy released by bond breaking is less than the energy absorbed for bond formation.

13 The mass of a beaker and its contents is plotted against time.

Which graph represents what happens when sodium carbonate reacts with an excess of dilute hydrochloric acid in an open beaker?



14 Copper metal donates electrons to silver ions.

Zinc metal donates electrons to copper ions.

What is the strongest reducing agent?

A copper ions

B copper metal

C silver ions

D zinc metal

15 Four statements about the effect of increasing temperature on a reaction are shown.

1 The activation energy becomes lower.

2 The particles move faster.

3 There are more collisions between reacting particles.

4 There are more collisions which have energy greater than the activation energy.

Which statements are correct?

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

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16 The formation of sulfur trioxide from sulfur dioxide is a reversible reaction.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

The forward reaction is exothermic.

Which changes would increase the equilibrium yield of SO_3?

1 increasing the pressure

2 lowering the temperature

3 decreasing the concentration of oxygen

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

17 Some properties of four oxides are listed.

Oxide 1 reacts with both acids and alkalis to form salts.

Oxide 2 reacts with acids to form salts but does not react with alkalis.

Oxide 3 reacts with alkalis to form salts but does not react with acids.

Oxide 4 does not react with acids or alkalis.

Which row describes the oxides?

	oxide 1	oxide 2	oxide 3	oxide 4
A	amphoteric	acidic	basic	neutral
B	amphoteric	basic	acidic	neutral
C	neutral	acidic	basic	amphoteric
D	neutral	basic	acidic	amphoteric

18 What is **not** a typical characteristic of acids?

A They react with alkalis producing water.

B They react with **all** metals producing hydrogen.

C They react with carbonates producing carbon dioxide.

D They turn blue litmus paper red.

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19 Copper(II) sulfate can be prepared by adding excess copper(II) carbonate to sulfuric acid.

Why is an **excess** of copper(II) carbonate added?

A to ensure all the copper(II) carbonate has reacted

B to ensure all the sulfuric acid has reacted

C to increase the rate of reaction

D to increase the yield of copper(II) sulfate

20 Compound P reacts with hydrochloric acid to produce a gas that turns limewater milky.

What is P?

A sodium carbonate

B sodium chloride

C sodium hydroxide

D sodium sulfate

21 Which statement about nitrogen and phosphorus is **not** correct?

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

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

C Both are non-metals.

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

22 Sodium and rubidium are elements in Group I of the Periodic Table.

Which statement is correct?

A Sodium atoms have more electrons than rubidium atoms.

B Sodium has a lower density than rubidium.

C Sodium has a lower melting point than rubidium.

D Sodium is more reactive than rubidium.

23 Which properties do the elements chromium, iron and vanadium have in common?

1 They all conduct electricity.

2 They, or their compounds, can act as catalysts.

3 They all form coloured compounds.

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

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24 Why is argon gas used to fill electric lamps?

A It conducts electricity.

B It glows when heated.

C It is less dense than air.

D It is not reactive.

25 What is a property of **all** metals?

A conduct electricity

B hard

C low melting points

D react with water

26 Aluminium is extracted from bauxite by electrolysis.

Which row shows the anode material and the anode reaction?

	anode material	anode reaction
A	carbon	$Al^{3+} + 3e^- \rightarrow Al$
B	carbon	$2O^{2-} \rightarrow O_2 + 4e^-$
C	steel	$Al^{3+} + 3e^- \rightarrow Al$
D	steel	$2O^{2-} \rightarrow O_2 + 4e^-$

27 Which statement about the metal zinc is **not** correct?

A It forms an oxide more readily than iron.

B It is manufactured by the electrolysis of zinc blende.

C It is used to make brass.

D It is used to prevent iron from rusting.

28 Calcium nitrate decomposes when it is heated.

What is the equation for the thermal decomposition of calcium nitrate?

A $2Ca(NO_3)_2 \rightarrow 2CaO + O_2 + 4NO_2$

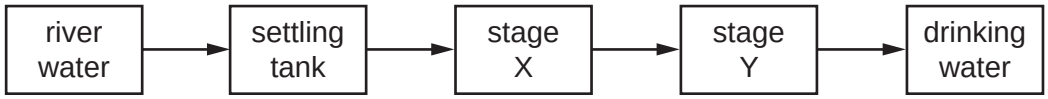
B $Ca(NO_3)_2 \rightarrow Ca(NO_2)_2 + O_2$

C $Ca(NO_3)_2 \rightarrow Ca + O_2 + 2NO_2$

D $Ca(NO_3)_2 \rightarrow Ca + 3O_2 + N_2$

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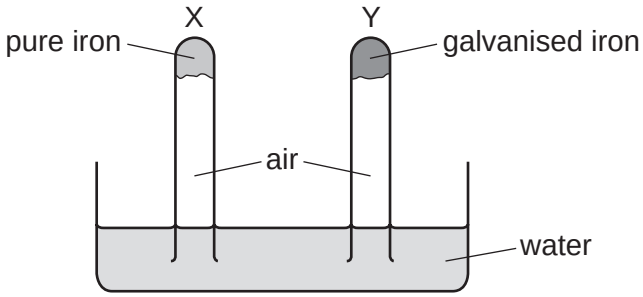
29 The flow chart shows stages in the treatment of river water to produce drinking water.



What occurs at stages X and Y?

	X	Y
A	distillation	chlorination
B	distillation	filtration
C	filtration	chlorination
D	filtration	distillation

30 An experiment to investigate the effect of galvanising iron is shown.



The experiment is left for seven days.

What happens to the water level in tubes X and Y?

	tube X	tube Y
A	falls	rises
B	no change	no change
C	rises	falls
D	rises	no change

31 Which metal is used as a catalyst in the Haber process for the manufacture of ammonia?

A iron

B nickel

C platinum

D vanadium

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32 Which process removes carbon dioxide from the atmosphere?

A combustion of fossil fuels

B decomposition of carbonates

C photosynthesis

D respiration

33 Which row shows the conditions used in the manufacture of sulfuric acid by the Contact process?

	temperature / °C	pressure / atm	catalyst
A	40	200	Fe
B	40	200	V_2O_5
C	400	2	Fe
D	400	2	V_2O_5

34 Some marble chips (calcium carbonate) are heated strongly and substances X and Y are formed.

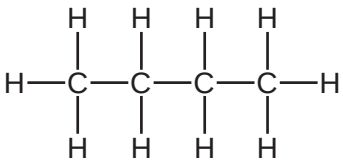
Substance X is a white solid that reacts with water, giving out heat. Substance Y is a colourless gas.

What are substances X and Y?

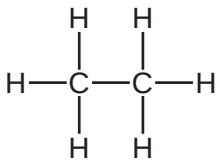
	X	Y
A	calcium chloride	oxygen
B	calcium hydroxide	carbon dioxide
C	calcium oxide	carbon dioxide
D	calcium sulfate	oxygen

35 The structures of four organic compounds are shown.

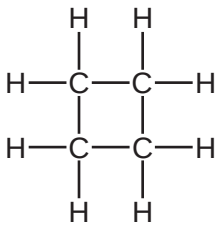
S



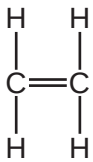
T



U



V



Which compounds are unsaturated?

A S only **B** T and U **C** U only **D** V only

36 Which statement is **not** correct?

A Petroleum is a mixture of hydrocarbons.

B The main constituent of natural gas is ethane.

C The naphtha fraction of petroleum is used for making chemicals.

D When natural gas burns in air, carbon dioxide and water are formed.

37 X, Y and Z are three hydrocarbons.

X $CH_2=CH_2$ Y $CH_3–CH=CH_2$ Z $CH_3–CH_2–CH=CH_2$

What do compounds X, Y and Z have in common?

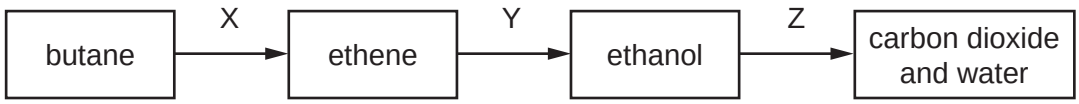
1 They are all alkenes.

2 They are all part of the same homologous series.

3 They all have the same boiling point.

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

38 The diagram shows a reaction sequence.

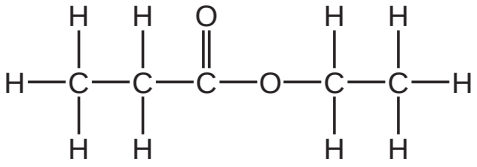


Which row names the processes X, Y and Z?

	X	Y	Z
A	cracking	fermentation	respiration
B	cracking	hydration	combustion
C	distillation	fermentation	respiration
D	distillation	hydration	combustion

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39 The structure of an ester is shown.



Which substances react to form this ester?

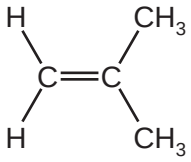
A ethanol and ethanoic acid

B ethanol and propanoic acid

C propanol and ethanoic acid

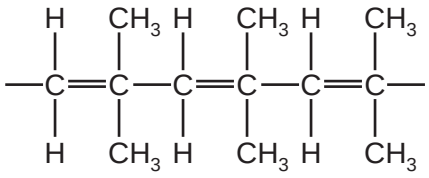
D propanol and propanoic acid

40 A polymer can be made from methyl propene.

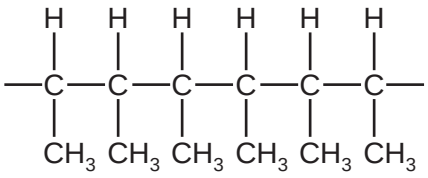


Which diagram shows the structure of the polymer?

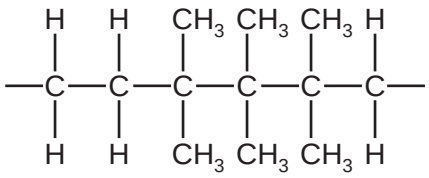
A



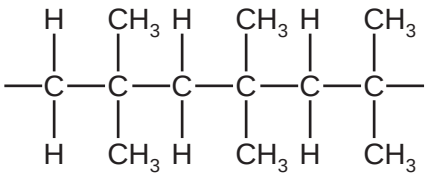
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C



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.).