Cambridge Assessment International Education

Cambridge IGCSE™

CO-ORDINATED SCIENCES **0654/21**

Paper 2 Multiple Choice (Extended) **May/June 2024**

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.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages. Any blank pages are indicated.

1 Which processes are done by green plants?

1 detect stimuli and make appropriate responses

2 break down nutrient molecules to release energy for metabolism

3 take in carbon dioxide, water and ions for energy, growth and development

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

2 Which conditions will result in the fastest rate of diffusion?

	temperature	concentration gradient	diffusion distance
A	high	large	short
B	high	small	long
C	low	small	short
D	low	large	long

3 A sample of food is tested for reducing sugars by adding Benedict's solution and heating.

What indicates that reducing sugars are present?

A a blue-black colour

B a brick-red precipitate

C a purple colour

D a white emulsion

4 Which statement about denaturation is correct?

A Denaturation is the change in shape of the active site of the enzyme at a pH above the optimum pH.

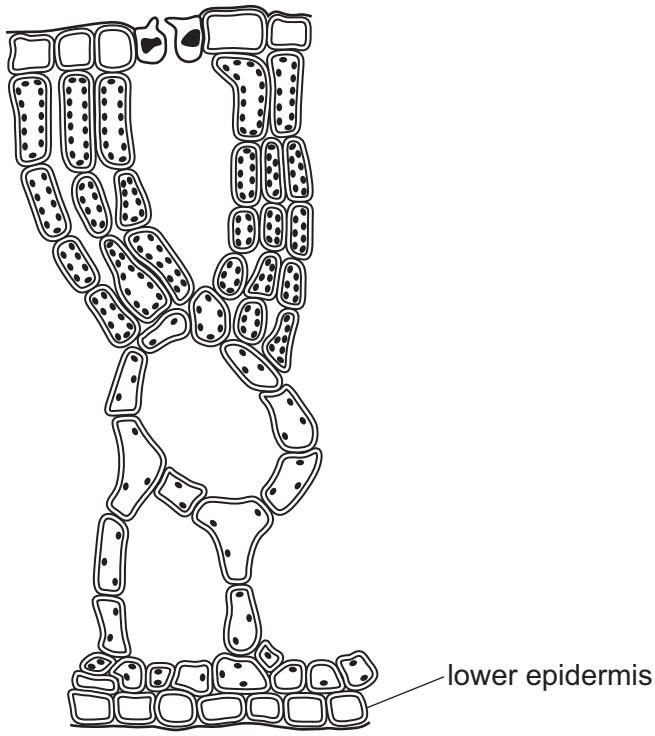
B Denaturation is the change in shape of the active site of the enzyme at a temperature below the optimum temperature.

C Denaturation is the change in shape of the active site of the substrate at a pH below the optimum pH.

D Denaturation is the change in shape of the active site of the substrate at a temperature above the optimum temperature.

5 The diagram shows a cross-section of a leaf of a plant.

The leaf is adapted to float on water with the upper epidermis exposed to the air.



Which statement explains one adaptation visible in the diagram?

A Guard cells in the lower epidermis are always closed to stop water escaping the leaf.

B The palisade mesophyll cells are next to the lower epidermis to maximise photosynthesis.

C The stomata are in the upper epidermis so that gas exchange with the air can take place.

D There is no cuticle in the upper epidermis to prevent water entering the leaf.

6 Humans have different types of teeth.

Which type of tooth is used for biting off food?

A canines

B incisors

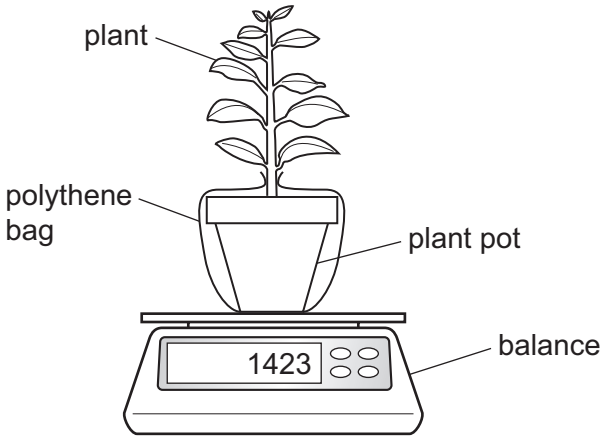
C premolars

D molars

[Turn over

7 A student investigates the effect of humidity on transpiration rate.

A plant is placed on a balance for one hour as shown. The mass of the plant decreases.



The student repeats the experiment in air of higher humidity.

What is the effect of increasing humidity?

A larger decrease in mass due to a steeper diffusion gradient of water

B larger decrease in mass due to a less steep diffusion gradient of water

C smaller decrease in mass due to a steeper diffusion gradient of water

D smaller decrease in mass due to a less steep diffusion gradient of water

8 A pupil runs to school.

What happens to the rate and depth of their breathing as they run?

	rate	depth
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

9 A person looks at a tree in the distance and then starts to read a book.

Which changes occur in the eye to enable the person to read their book?

	ciliary muscles	suspensory ligaments	lens
A	contract	slacken	becomes fatter
B	contract	tighten	becomes thinner
C	relax	slacken	becomes fatter
D	relax	tighten	becomes thinner

10 Which row describes asexual reproduction?

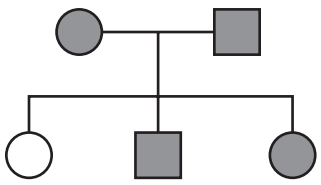
	only one parent	fusion of nuclei	genetically identical offspring
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key

✓ = yes

✗ = no

11 The diagram shows the inheritance of a disease.



key

unaffected female

unaffected male

affected female

affected male

Which row is correct for the parents and the allele for the disease?

	parents	allele for the disease
A	heterozygous	dominant
B	heterozygous	recessive
C	homozygous	dominant
D	homozygous	recessive

12 How does an organism in the first trophic level gain energy?

A by absorbing energy from sunlight

B by breaking down dead or waste organic matter

C by eating organisms in the second trophic level

D by eating plants

13 The list shows changes that occur in a lake which is polluted by fertiliser.

1 Decomposers feed on aquatic plants.

2 Growth of algae increases.

3 Oxygen levels decrease in the lake.

4 Aquatic plants die.

In which order do these changes occur?

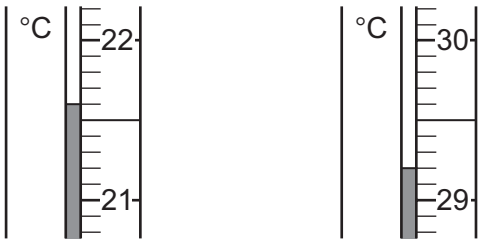
A $2 \rightarrow 4 \rightarrow 1 \rightarrow 3$

B $2 \rightarrow 3 \rightarrow 4 \rightarrow 1$

C $3 \rightarrow 4 \rightarrow 2 \rightarrow 1$

D $3 \rightarrow 4 \rightarrow 1 \rightarrow 2$

14 The initial and final readings on a sensitive thermometer used in an experiment are shown.



initial final

What is the temperature change for this experiment?

A 0.4 **B** 4.0 **C** 6.8 **D** 7.6

15 The boiling point of ammonia is –33 °C.

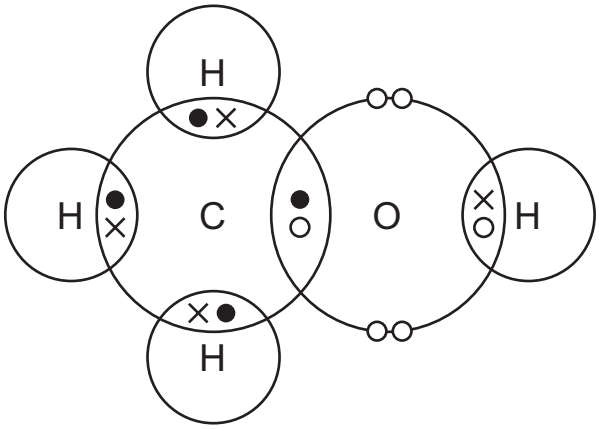
The temperature of a sealed flask containing ammonia is changed from –35 °C to –30 °C.

Which row describes and explains the type of change that happens in the flask?

	type of change	explanation
A	chemical	no new substance is formed
B	chemical	hydrogen and nitrogen are formed
C	physical	no new substance is formed
D	physical	hydrogen and nitrogen are formed

16 Which dot-and-cross diagram represents the outer-shell electrons in a molecule of methanol?

A



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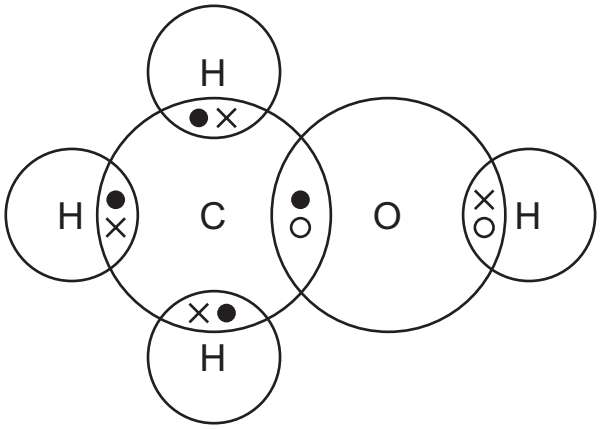
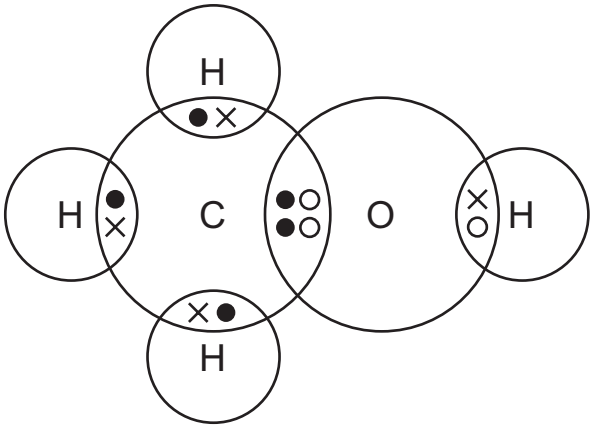
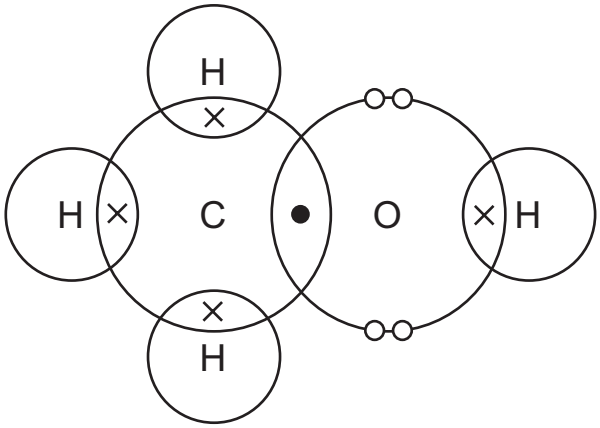


C



D



17 Which statements describe the structure of silicon(IV) oxide?

1 Each oxygen atom is attached to two silicon atoms.

2 Each oxygen atom is attached to four silicon atoms.

3 Each silicon atom is attached to two oxygen atoms.

4 Each silicon atom is attached to four oxygen atoms.

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

18 The equation for the combustion of magnesium is shown.

$$2Mg + O_2 \rightarrow 2MgO$$

What is the mass of magnesium oxide formed from 12 g of magnesium?

A 20 g **B** 24 g **C** 40 g **D** 80 g

19 Two electrolysis experiments are done using inert electrodes.

Experiment 1 is the electrolysis of aqueous copper(II) sulfate.

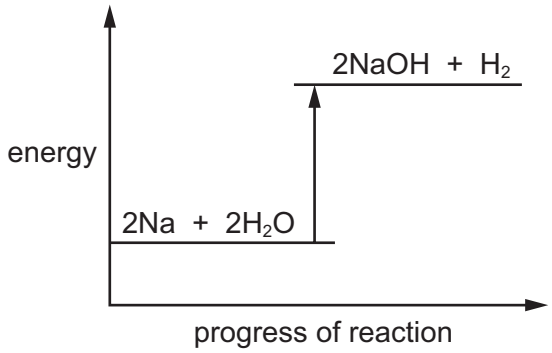
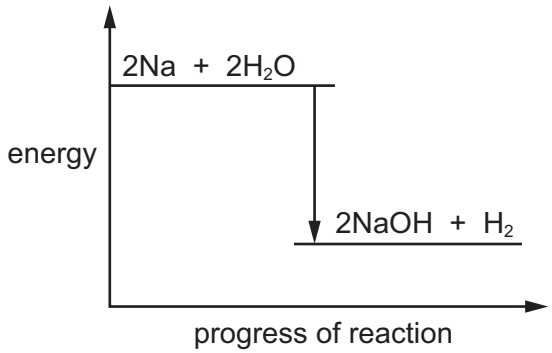
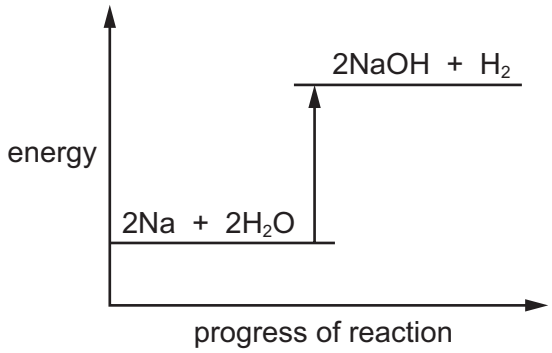
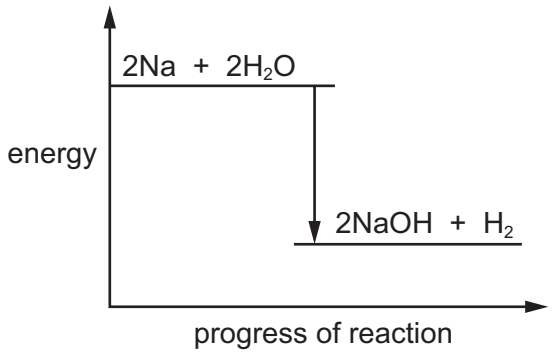
Experiment 2 is the electrolysis of molten lithium bromide.

Which row describes the products at each electrode in these experiments?

	experiment 1		experiment 2	
	cathode	anode	cathode	anode
A	copper	oxygen	bromine	lithium
B	oxygen	copper	lithium	bromine
C	copper	oxygen	lithium	bromine
D	oxygen	copper	bromine	lithium

20 A piece of sodium is added to water.

Which row shows the type of reaction and the energy level diagram for the reaction?

	type of reaction	energy level diagram
A	endothermic	
B	endothermic	
C	exothermic	
D	exothermic	

21 Magnesium ribbon is reacted with 50 cm^3 of dilute hydrochloric acid.

Which change does **not** increase the rate of the reaction?

A Increase the concentration of the hydrochloric acid.

B Increase the temperature of the hydrochloric acid.

C Increase the volume of the hydrochloric acid.

D Use powdered magnesium.

22 Which metal is used in the test for nitrate ions?

A aluminium

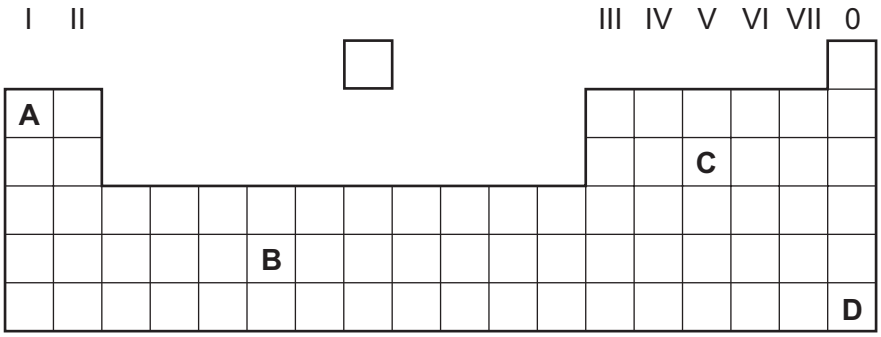
B copper

C magnesium

D tin

23 Element X is a dense solid with a high melting point.

Which letter shows the position of X in the Periodic Table?



24 Which statement about noble gases is correct?

A All of the noble gas atoms have eight electrons in their outer shell.

B They all form diatomic molecules.

C Argon is used to fill weather balloons.

D They are all present in clean air in small amounts.

25 Which statements about the Haber process are correct?

1 The hydrogen used is obtained from the air.

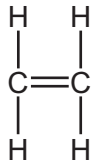
2 The pressure used is about twice atmospheric pressure.

3 The catalyst used is iron.

4 The process takes place at a temperature of about 450 °C.

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

26 The structure of a molecule of compound X is shown.



Which two formulas represent compounds that are in the same homologous series as X?

A C_5H_{10} and C_5H_{12}

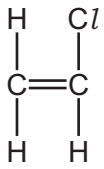
B C_4H_{10} and C_6H_{14}

C C_3H_6 and C_5H_{10}

D C_3H_6 and C_4H_{10}

27 Which molecules can be used as monomers in polymerisation processes?

1



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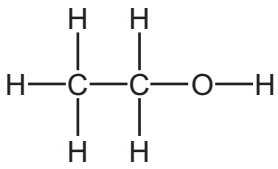

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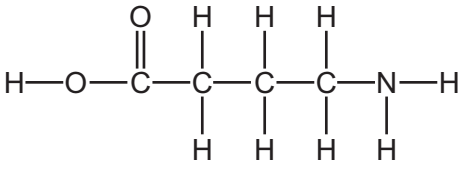

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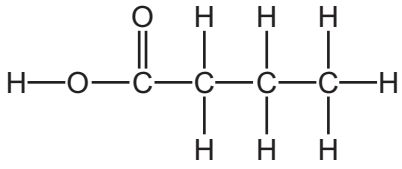

A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

28 Which statement describes a system that is in equilibrium?

A There is a resultant force and there is a resultant turning effect on the system.

B There is a resultant force but there is no resultant turning effect on the system.

C There is no resultant force but there is a resultant turning effect on the system.

D There is no resultant force and there is no resultant turning effect on the system.

29 An irregularly shaped piece of aluminium is lowered into a measuring cylinder that contains 43 cm^3 of water. The aluminium is totally immersed in the water and the water level in the measuring cylinder rises to 51 cm^3. The density of aluminium is 2.7 g/cm^3.

What is the mass of the aluminium?

A 15.9 g **B** 18.9 g **C** 21.6 g **D** 127 g

30 An object of mass 5.0 kg falls vertically from rest through a height of 13 m in a vacuum.

The gravitational field strength *g* is 10 N/kg.

What is the final speed of the object?

A 8.1 m/s **B** 10 m/s **C** 11 m/s **D** 16 m/s

31 For which energy resource is the Sun **not** the source of the energy?

A geothermal

B natural gas

C water behind a hydroelectric dam

D wind

32 In a room, hot air above a heater rises and is replaced by cool air that falls.

What is the name of this process, and how does the density of the hot air compare with the density of the cool air?

	process	density of hot air
A	conduction	greater than cool air
B	conduction	less than cool air
C	convection	greater than cool air
D	convection	less than cool air

33 A wave has an amplitude, a frequency and a wavelength.

Three definitions for these quantities are given.

1 the maximum displacement from the rest position

2 the number of wavefronts passing a point in unit time

3 the distance between two adjacent wave crests

Which definition corresponds to each quantity?

	amplitude	frequency	wavelength
A	1	2	3
B	1	3	2
C	2	3	1
D	3	1	2

34 A thin converging lens produces a real image of an object.

What happens to the image as the object is moved away from the lens?

A It becomes larger and stays inverted.

B It becomes larger and stays upright.

C It becomes smaller and stays inverted.

D It becomes smaller and stays upright.

35 A bar of soft iron and a bar of steel are held in contact with a strong magnet.

Both bars become magnetised.

The two bars are now moved away from the magnet.

Which statement about the bars is correct?

A Both bars lose their magnetism.

B Neither of the bars loses its magnetism.

C The soft iron bar loses its magnetism but the steel bar retains its magnetism.

D The steel bar loses its magnetism but the soft iron bar retains its magnetism.

36 The current in an ammeter is 1.5 A.

How much charge passes through the ammeter in one minute?

A 0.025 C **B** 1.5 C **C** 40 C **D** 90 C

37 Two resistors with different resistances are connected to a power supply. The resistors can be connected either in parallel or in series.

Which statement is correct?

A For resistors in parallel, the currents in the resistors are equal.

B For resistors in parallel, the potential differences (p.d.s) across the resistors are different.

C For resistors in series, the currents in the resistors are equal.

D For resistors in series, the potential differences (p.d.s) across the resistors are equal.

38 There is an alternating current (a.c.) in a metal wire.

Which statement about the current is correct?

A It is a flow of both positively and negatively charged particles.

B It is a flow of charged particles, first in one direction then in the opposite direction repeatedly.

C It is a flow of charged particles in both directions at the same time.

D It is a flow of charged particles steadily in one direction.

39 A 100% efficient step-down transformer has 120 turns on its primary coil and 10 turns on its secondary coil.

A 240 V supply provides 48 W of power to the primary coil.

What is the current in the secondary coil?

A 0.017 A **B** 0.2 A **C** 2.4 A **D** 20 A

40 A proton has charge q and mass m. A neutron has no charge and mass m.

Which row shows the charge and mass of an alpha (α)-particle?

	charge	mass
A	$2q$	$2m$
B	$2q$	$4m$
C	$4q$	$2m$
D	$4q$	$4m$

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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 –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

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.).