Cambridge Assessment International Education

Cambridge IGCSE™

PHYSICAL SCIENCE **0652/21**

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

1 Which statement describes and explains the relative rates of diffusion of carbon dioxide and of methane?

A Carbon dioxide diffuses more rapidly because its molecules have a higher relative molecular mass than molecules of methane.

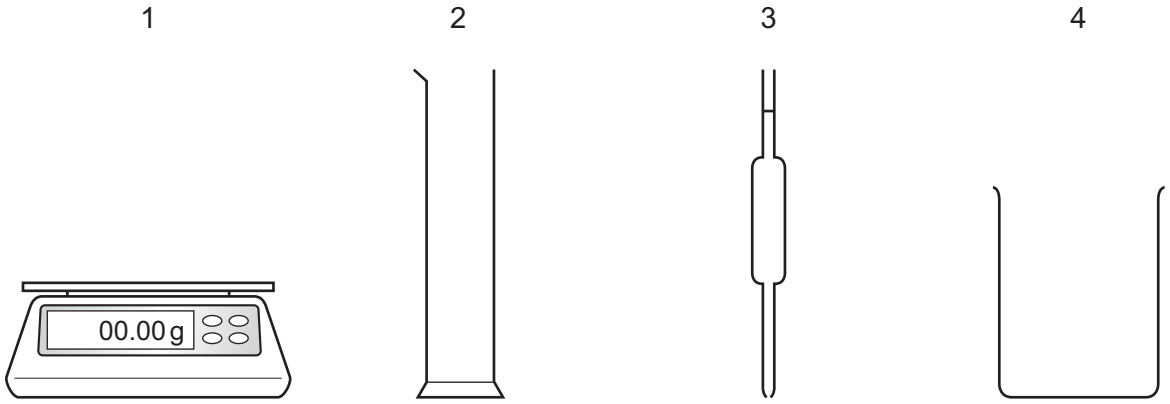
B Carbon dioxide diffuses more rapidly because its molecules have a lower relative molecular mass than molecules of methane.

C Methane diffuses more rapidly because its molecules have a higher relative molecular mass than molecules of carbon dioxide.

D Methane diffuses more rapidly because its molecules have a lower relative molecular mass than molecules of carbon dioxide.

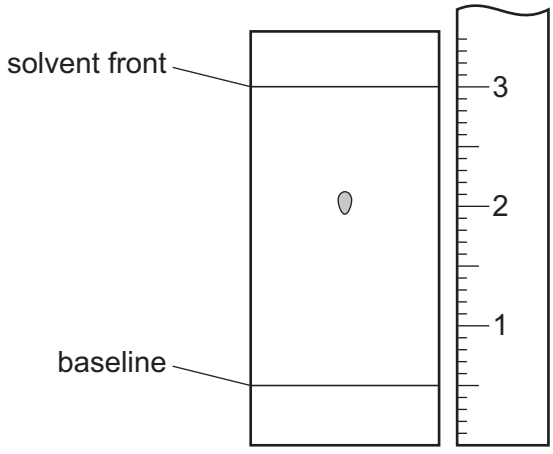
2 In an experiment, the mass of a sample of solid calcium carbonate is measured and added to a conical flask containing exactly 25.0 cm^3 of dilute hydrochloric acid.

Which additional pieces of apparatus are required for this experiment?



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

3 The chromatogram obtained from a coloured dye and part of a ruler are shown.



What is the R_f value of the coloured dye?

A 0.33 **B** 0.40 **C** 0.60 **D** 0.66

4 Some salt is dissolved in water to form a solution.

More water is added to the solution.

Which row identifies the solute and the change in concentration of the salt solution?

	solute	change in concentration
A	salt	decrease
B	salt	increase
C	water	decrease
D	water	increase

5 Which statement about solid sodium chloride is correct?

A It contains negative ions formed by the gain of electrons by sodium atoms.

B It has a lattice structure with alternating positive and negative ions.

C There are strong attractions between sodium atoms and chlorine atoms.

D There are weak attractions between oppositely charged ions.

6 In which pair of molecules do both molecules use the same number of electrons to form covalent bonds?

A C_2H_4 and CH_3OH

B CO_2 and CH_4

C N_2 and O_2

D NH_3 and H_2O

7 Which statement about the structure of diamond is correct?

A Each atom has only three covalent bonds.

B Electrons in the structure are free to move.

C It is made up of layers of atoms.

D It is tetrahedral.

8 The equation for the decomposition of hydrogen peroxide, H_2O_2, is shown.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

Which volume of oxygen at r.t.p. is produced when $20.0\,cm^3$ of $0.05\,mol/dm^3$ of H_2O_2 decomposes?

A $0.012\,dm^3$ **B** $0.016\,dm^3$ **C** $0.024\,dm^3$ **D** $0.032\,dm^3$

9 Molten sodium iodide is electrolysed using inert electrodes.

Which row identifies the ions that move to the cathode and what happens to those ions at the cathode?

	ion	what happens to those ions
A	iodide	gain electrons
B	iodide	lose electrons
C	sodium	gain electrons
D	sodium	lose electrons

10 The rate of a chemical reaction changes when the conditions are changed.

Which change in conditions increases **both** the frequency of collisions between particles **and** the number of particles that possess the activation energy?

A increasing the concentration

B increasing the temperature

C decreasing the particle size

D stirring the reaction mixture

11 Which row about oxidation reactions is correct?

	oxidation	oxidising agent
A	gain of oxygen	loses oxygen
B	gain of oxygen	gains oxygen
C	loss of oxygen	loses oxygen
D	loss of oxygen	gains oxygen

12 Which statement describes the behaviour of an acid and a base in aqueous solution?

A An acid accepts electrons and a base donates electrons.

B An acid donates electrons and a base accepts electrons.

C An acid accepts protons and a base donates protons.

D An acid donates protons and a base accepts protons.

13 A sample of aqueous copper(II) chloride is mixed with aqueous ammonia until the ammonia is in excess.

A separate sample of aqueous copper(II) chloride is mixed with acidified aqueous silver nitrate.

Which observations are correct?

	excess aqueous ammonia	acidified aqueous silver nitrate
A	blue precipitate	colourless solution
B	blue precipitate	white precipitate
C	blue solution	colourless solution
D	blue solution	white precipitate

14 Lithium has a lower density than sodium. Sodium is more reactive than lithium.

Which statement predicts the properties of the Group I element, rubidium?

A It is less dense and less reactive than sodium.

B It is less dense and more reactive than sodium.

C It is more dense and less reactive than sodium.

D It is more dense and more reactive than sodium.

15 Which statements describe properties of transition elements?

1 They do **not** conduct electricity when solid.

2 They form coloured compounds.

3 They have high densities.

4 They have low melting points.

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

16 Zinc is a metal which has many uses.

When zinc is mixed with copper it forms .....1..... which is an .....2..... .

Zinc is also used in the process of .....3..... to protect iron.

Which words correctly complete gaps 1, 2 and 3?

	1	2	3
A	brass	alkali	rusting
B	brass	alloy	galvanising
C	brass	alloy	rusting
D	steel	alloy	galvanising

17 Which statement is correct?

A Carbon dioxide, formed by the complete combustion of carbon-containing substances, is a greenhouse gas.

B Carbon dioxide, formed by the incomplete combustion of carbon-containing substances, is a greenhouse gas.

C Carbon monoxide, formed by the complete combustion of carbon-containing substances, is a greenhouse gas.

D Carbon monoxide, formed by the incomplete combustion of carbon-containing substances, is a greenhouse gas.

18 Which statement about lime (calcium oxide) is correct?

A It is manufactured by the action of heat on hematite.

B It is manufactured by the action of heat on limestone.

C It is used to increase the acidity of soils.

D It is used to neutralise alkaline industrial waste.

19 One member of the alkane homologous series is butane which is used as a fuel.

What are the products of combustion when butane is burned in excess air?

A carbon and water

B carbon dioxide and hydrogen

C carbon dioxide and water

D carbon monoxide and water

20 The formulae of four compounds are shown.

1 C_2H_6

2 C_4H_8

3 C_7H_{14}

4 $C_{10}H_{22}$

Which compounds will decolourise bromine water?

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

21 How is the velocity of a moving object related to the speed of the object?

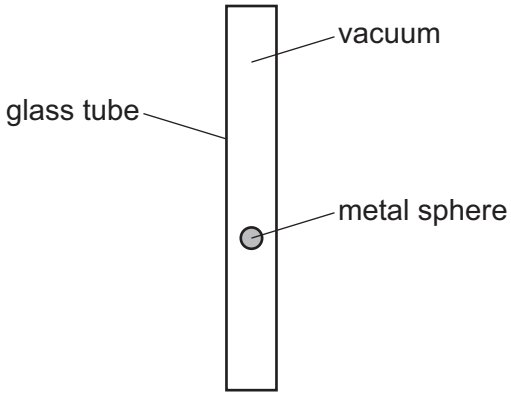
A Speed has the same magnitude as velocity but speed also has direction.

B Speed is equal to the rate of change of velocity.

C Velocity has the same magnitude as speed but velocity also has direction.

D Velocity is equal to the rate of change of speed.

22 In an experiment, a metal sphere falls in a vacuum.



Which statement is correct?

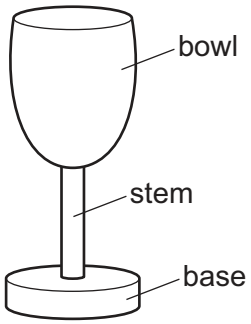
A The sphere falls with constant, non-zero acceleration.

B The sphere falls with decreasing acceleration.

C The sphere falls with increasing acceleration.

D The sphere falls with zero acceleration.

23 The diagram shows a glass that can hold water. The parts of the glass are labelled.



Which change makes the glass more stable?

A filling the bowl with water

B making the base heavier

C making the bowl larger

D making the stem longer

24 A student does work by pulling a box across a horizontal floor.

She now pulls a second box across the same floor.

Which row indicates that the student does twice as much work when pulling the second box?

	force used to pull second box	distance second box is pulled
A	doubled	doubled
B	doubled	halved
C	stays the same	doubled
D	stays the same	halved

25 A ball of mass 200 g is thrown with an initial speed of 20 m / s.

What is the initial kinetic energy of the ball?

A 4.0 J **B** 40 J **C** 400 J **D** 40 000 J

26 A power station uses nuclear fission to generate electricity.

In this process, energy from the nuclear fuel is transferred to energy in water.

What is the energy stored in the water?

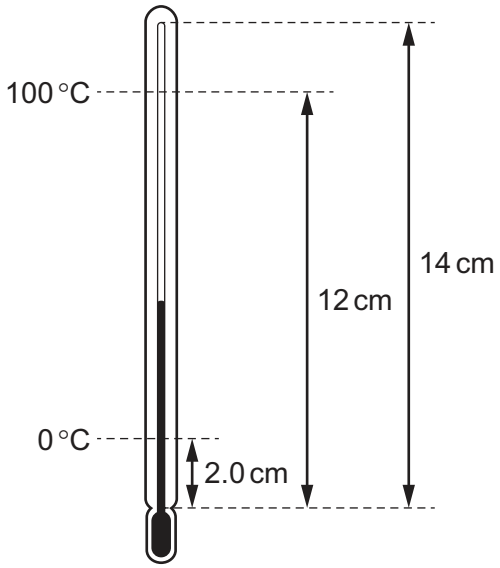
A chemical energy

B electrical energy

C gravitational energy

D thermal energy

27 The diagram shows the dimensions of a liquid-in-glass thermometer and the positions of two fixed points on the thermometer scale.



What is the maximum range of the thermometer?

A –10 °C to 110 °C

B –10 °C to 120 °C

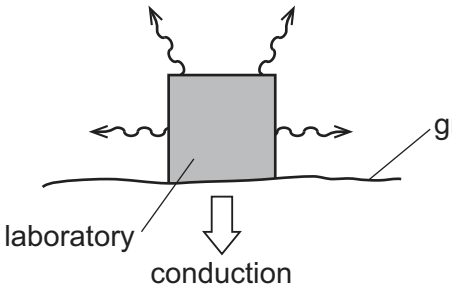
C –20 °C to 110 °C

D –20 °C to 120 °C

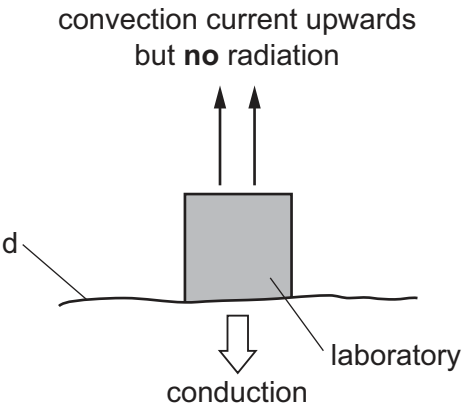
28 A laboratory is built on the Moon. There is no air on the Moon.

Which diagram shows how energy is lost as heat from the laboratory?

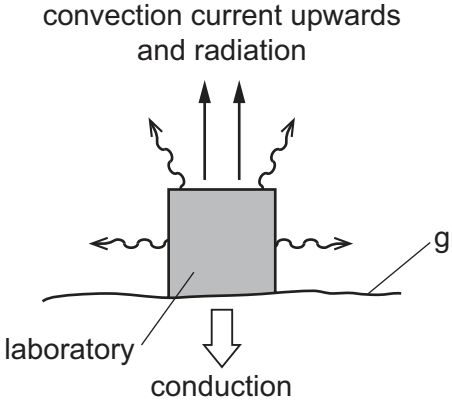
A



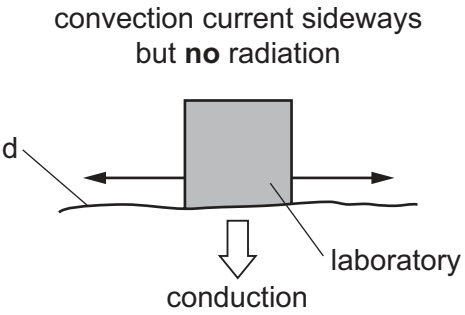
B



C



D



29 Which row describes what a wave does?

	transfers energy	transfers matter
A	no	no
B	no	yes
C	yes	no
D	yes	yes

30 A converging lens of focal length 15 cm is used as a magnifying glass to produce a virtual, magnified image of an object.

What is a possible position of the object?

A 8.0 cm from the lens

B 16 cm from the lens

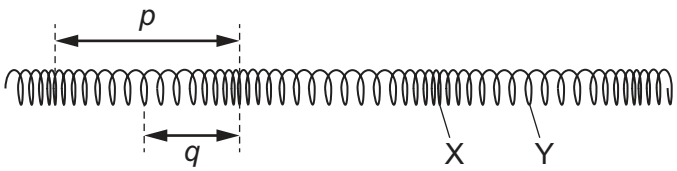
C 32 cm from the lens

D 64 cm from the lens

31 Which row contains electromagnetic waves in order of increasing wavelength?

	smallest wavelength →			largest wavelength
A	ultraviolet	X-rays	microwaves	radio
B	visible light	infrared	radio	gamma (γ)-rays
C	visible light	ultraviolet	X-rays	gamma (γ)-rays
D	X-rays	ultraviolet	visible light	microwaves

32 The diagram shows a longitudinal wave on a spring. Two lengths *p* and *q* are marked, and two points X and Y are labelled.

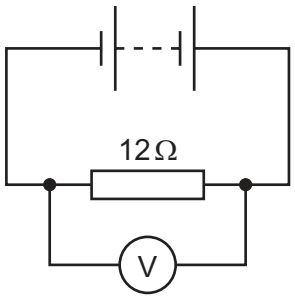


Which row gives the wavelength of the wave and labels the points marking a compression and a rarefaction?

	wavelength	compression	rarefaction
A	*p*	X	Y
B	*p*	Y	X
C	*q*	X	Y
D	*q*	Y	X

33 The diagram shows a battery connected to a 12 Ω resistor and a voltmeter.

The reading on the voltmeter is 24 V.

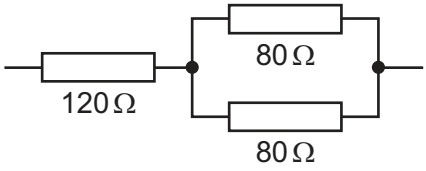


Which row shows the current in the circuit and the electromotive force (e.m.f.) of the battery?

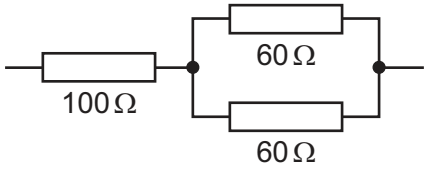
	current in circuit / A	e.m.f. of battery / V
A	0.50	2.0
B	0.50	24
C	2.0	2.0
D	2.0	24

34 Which resistor combination has a combined resistance of 160 Ω?

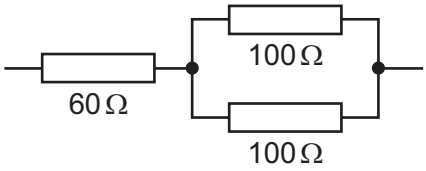
A



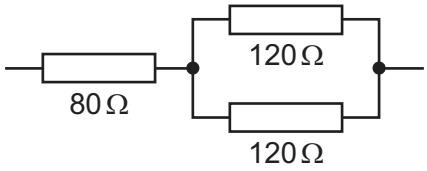
B



C



D



35 The current in an electric heater is 8.0 A. The circuit of the heater is **not** fitted with a fuse.

The heater is switched off and a 5.0 A fuse is added to the circuit of the heater.

What happens now when the heater is switched on?

A The heater works normally.

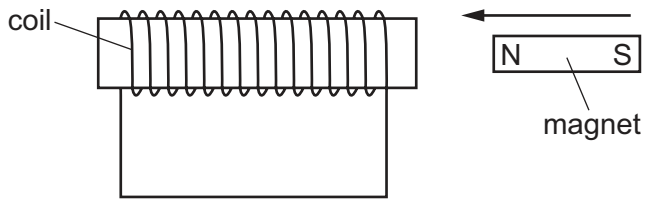
B The fuse blows and the heater becomes hotter than before.

C The fuse blows and the heater does **not** become hot.

D The metal casing of the heater becomes live.

36 A magnet is pushed towards a coil of wire.

An electromotive force (e.m.f.) is induced across the ends of the coil.



The induced e.m.f. causes a force to act on the magnet.

In which direction does this force act on the magnet?

A downwards

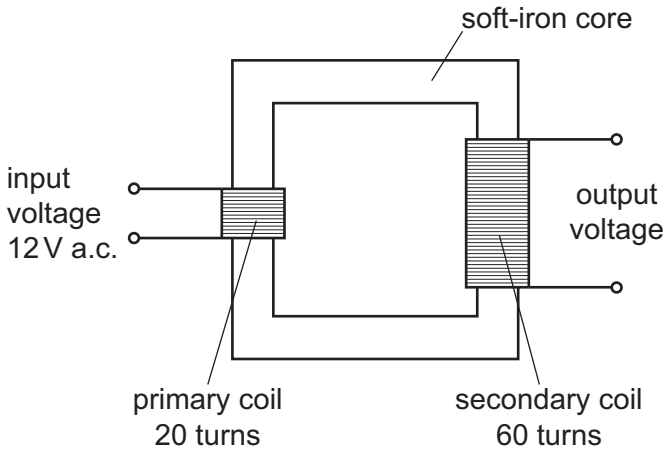
B upwards

C to the left

D to the right

37 A transformer is 100% efficient. The transformer has 20 turns on the primary coil and 60 turns on the secondary coil.

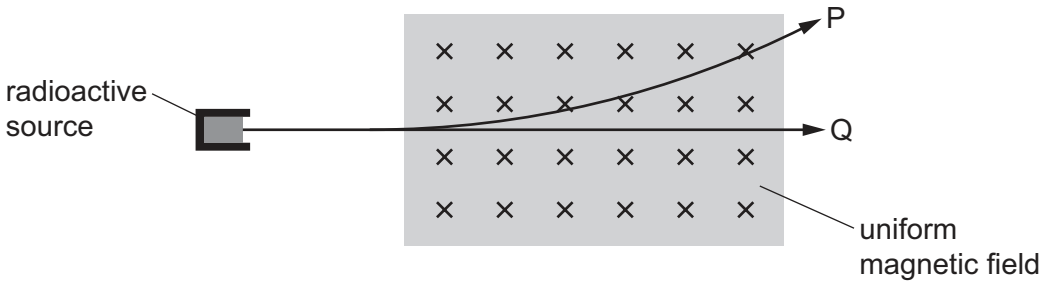
The primary coil is connected to a 12 V a.c. supply.



What is the output voltage?

A 0.010 V **B** 4.0 V **C** 36 V **D** 100 V

38 The diagram shows two types of emission from a radioactive source. The emissions pass through a uniform magnetic field directed into the page. One type of emission follows path P and the other type of emission follows path Q.



What are the emissions that follow paths P and Q?

	P	Q
A	α	β
B	α	γ
C	β	α
D	β	γ

39 Strontium-90 (Sr) is a radioactive isotope. A nucleus of strontium-90 undergoes β-decay to form an yttrium (Y) nucleus. The decay is represented by the equation shown.

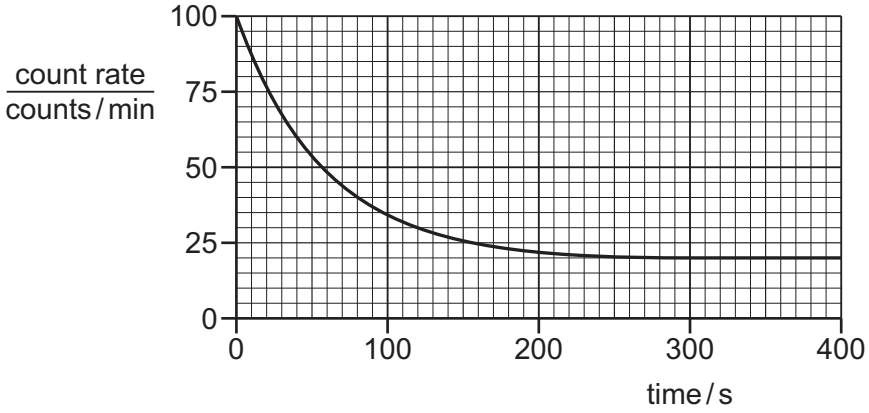
$$^{90}_{p}\mathrm{Sr} \rightarrow {}^{90}_{39}\mathrm{Y} + {}^{0}_{q}\beta$$

What are the numbers *p* and *q*?

	p	*q*
A	38	+1
B	38	–1
C	40	+1
D	40	–1

40 A sample of a radioactive isotope is placed near a detector in a laboratory, with no shielding from background radiation.

The graph shows how the count rate from the detector varies with time.



What is the half-life of the isotope?

A 40 s **B** 55 s **C** 79 s **D** 150 s

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.).