



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICAL SCIENCE

0652/21

Paper 2 Multiple Choice

October/November 2017

45 minutes

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

* 7 4 2 5 1 2 3 1 1 2 *

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.

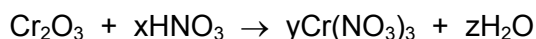
A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

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

- 1 What is the name of the process by which gas particles move to occupy all the available space?
- A boiling
 - B condensation
 - C diffusion
 - D evaporation
- 2 An atom of sodium contains 11 protons, 11 electrons and 12 neutrons.
What is the nucleon number of the atom?
- A 11 B 12 C 22 D 23
- 3 Which statement describes the formation of the bonds in magnesium chloride?
- A Chlorine atoms transfer electrons to magnesium atoms forming an ionic bond.
 - B Magnesium atoms and chlorine atoms share a pair of electrons forming a covalent bond.
 - C Magnesium atoms transfer electrons to chlorine atoms forming a covalent bond.
 - D Magnesium atoms transfer electrons to chlorine atoms forming an ionic bond.
- 4 Which statement explains why graphite conducts electricity?
- A All of the electrons in graphite are free to move through its structure.
 - B Each carbon atom has three covalent bonds and one electron free to move through the structure.
 - C Graphite is a metal and the outer shell electrons are free to move.
 - D The electrons in the covalent bonds are free to move through the structure.
- 5 The formula of a gallium ion is Ga^{3+} .
The formula of a sulfate ion is SO_4^{2-} .
What is the formula of gallium sulfate?
- A GaSO_4 B Ga_2SO_3 C $\text{Ga}_2(\text{SO}_4)_3$ D $\text{Ga}_3(\text{SO}_4)_2$

- 6 Chromium(III) oxide reacts with dilute nitric acid to give chromium(III) nitrate and water.



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

	x	y	z
A	3	1	3
B	3	2	6
C	6	2	3
D	6	2	6

- 7 Which compound has the largest relative molecular mass, M_r ?

A CO_2 **B** NO_2 **C** SiO_2 **D** SO_2

- 8 The diagram shows wood burning in air.

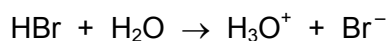


Which two words describe what happens to the wood and the type of reaction taking place?

	wood is	type of reaction
A	oxidised	endothermic
B	oxidised	exothermic
C	reduced	endothermic
D	reduced	exothermic

- 9 Hydrogen bromide gas reacts with water to produce an acidic solution.

The equation for the reaction is



Which statement describes what happens during the reaction?

- A** Bromine accepts an electron from the water.
B Hydrogen bromide accepts a proton from the water.
C Hydrogen bromide donates a proton to the water.
D Hydrogen bromide loses an electron to the water.
- 10 Four methods of preparing salts are shown.
- 1 adding an excess of an insoluble carbonate to a dilute acid and removing the excess by filtration
 - 2 adding an excess of an insoluble metal oxide to a dilute acid and removing the excess by filtration
 - 3 precipitation
 - 4 titration using an acid and an alkali

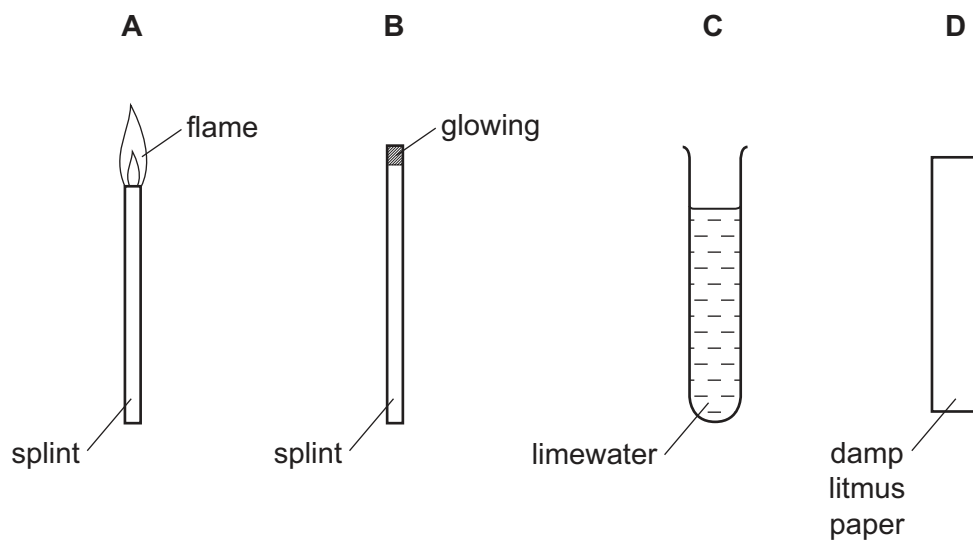
The solubility of some lead compounds is shown.

compound	solubility
lead carbonate	insoluble
lead hydroxide	insoluble
lead oxide	insoluble
lead nitrate	soluble
lead sulfate	insoluble

Which methods could be used to make lead nitrate?

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

11 Which test is used to show that a gas is ammonia?



12 An element Z has the electronic structure 2,8,5.

In which group in the Periodic Table is Z placed?

- A** 2 **B** 3 **C** 5 **D** 8

13 The elements in Group VI of the Periodic Table show the same trends as the elements in Group VII.

Which row describes the trend in melting point and density of the Group VI elements as the group is descended?

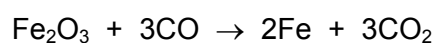
	melting point	density
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

14 Bauxite and haematite are important ores.

Which metals do the ores contain?

	bauxite	haematite
A	Al	Cu
B	Al	Fe
C	Cu	Al
D	Fe	Cu

15 One of the reactions that occurs in a blast furnace is shown.



Which substance is the reducing agent?

- A** CO **B** CO₂ **C** Fe **D** Fe₂O₃

16 Which property of a metal makes it **not** suitable for aircraft bodies?

- A** high density
B high malleability
C high strength
D low reactivity

17 Nitrogen oxides are produced in a car engine.

Which process describes how the nitrogen oxides are catalytically removed in the exhaust fumes?

- A** combustion
B oxidation
C reduction
D thermal decomposition

18 Which row describes compounds in the same homologous series?

	chemical properties	functional group
A	different	different
B	different	the same
C	similar	different
D	similar	the same

19 When decane is heated over a catalyst, it breaks down to make octane and ethene.

Which name is given to this process?

- A** cracking
- B** distilling
- C** polymerising
- D** reducing

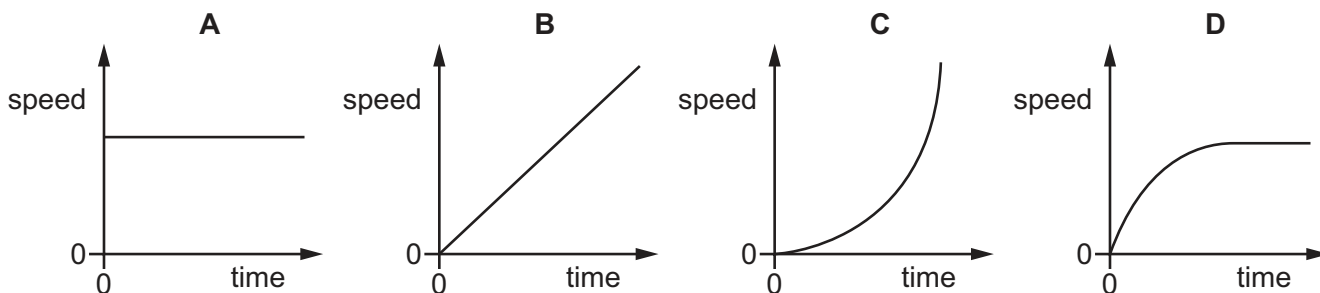
20 Limonene is a colourless, unsaturated hydrocarbon found in lemons.

Which row describes the colour change when a few drops of limonene are shaken with bromine?

	colour of bromine at the start of experiment	colour of bromine after mixing with limonene
A	colourless	colourless
B	colourless	orange
C	orange	colourless
D	orange	orange

21 An object falls vertically in air, from rest, through a large distance. Air resistance acts on the object.

Which speed-time graph represents the motion of the object?



22 A student does work by pulling a case across a horizontal floor.

She now pulls a second case along the same floor.

Which row indicates that the student is now doing twice as much work?

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

23 A metal container has a mass of 200 kg.

The container is filled with 1.00 m^3 of a liquid. The total mass is now 1000 kg.

What is the density of the liquid?

A 0.00125 kg/m^3

B 0.00500 kg/m^3

C 800 kg/m^3

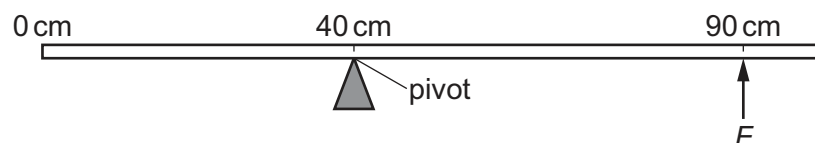
D 1000 kg/m^3

24 Which row correctly describes iron and lead?

	iron	lead
A	ferrous	ferrous
B	ferrous	non-ferrous
C	non-ferrous	ferrous
D	non-ferrous	non-ferrous

25 A uniform metre rule of weight 2.0 N is pivoted at the 40 cm mark.

The rule is held in equilibrium by force F acting at the 90 cm mark.



What is F ?

- A 0.22 N B 0.40 N C 0.89 N D 1.6 N

26 An object of mass m moving with velocity v has kinetic energy E .

What is the kinetic energy of an object of mass $4.0m$ moving with velocity $2.0v$?

- A $2.0E$ B $4.0E$ C $8.0E$ D $16.0E$

27 A power station uses nuclear fission to obtain energy.

In this process, nuclear energy is **first** transferred to

- A chemical energy.
 B electrical energy.
 C gravitational energy.
 D thermal (heat) energy.

28 A student has two mercury-in-glass thermometers P and Q. They contain equal volumes of mercury.

Thermometer Q has a longer stem and a wider capillary bore than thermometer P.

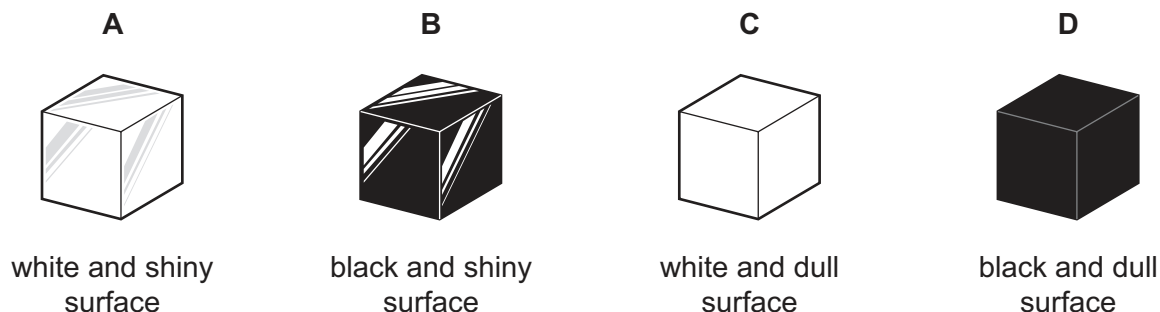
Which row compares the range and the sensitivity of thermometer Q with those of thermometer P?

	range of Q compared with P	sensitivity of Q compared with P
A	greater	greater
B	greater	smaller
C	smaller	greater
D	smaller	smaller

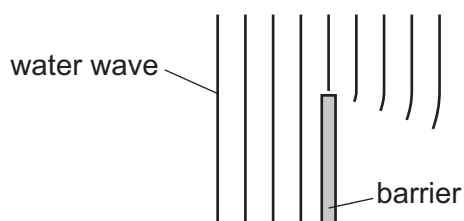
- 29 The diagram shows four identical copper blocks. The blocks have been painted so that their surfaces are different.

All four blocks are heated to the same temperature, in the same room.

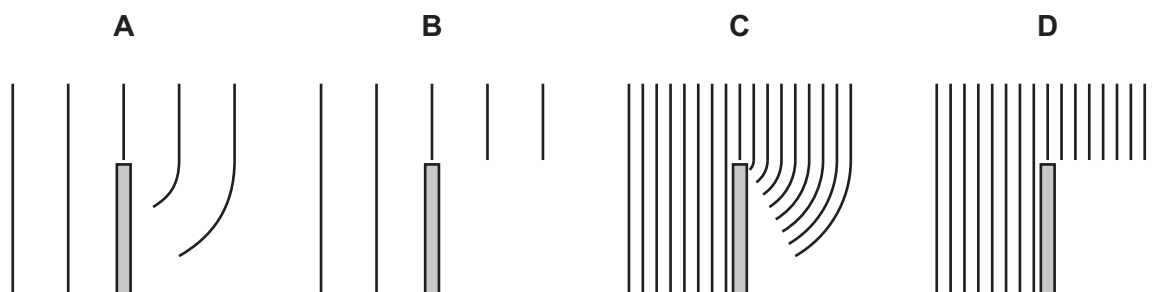
Which block cools the most slowly?



- 30 The diagram shows a water wave being diffracted at the edge of a barrier.



Which diagram shows water waves of half the frequency being diffracted at the edge of the same barrier?

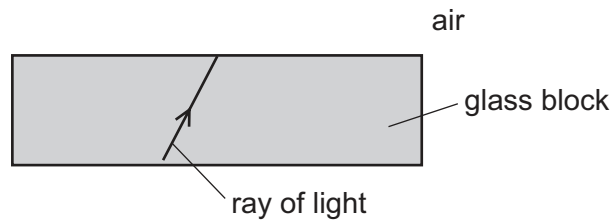


- 31 The table gives information about the approximate speed and range of wavelengths of waves.

Which row describes monochromatic microwaves in a vacuum?

	approximate speed	wavelengths
A	300 m/s	all the same
B	300 m/s	a range of different values
C	300 000 km/s	all the same
D	300 000 km/s	a range of different values

- 32 A ray of light in a glass block strikes the edge of the block. The angle of incidence is much smaller than the critical angle.

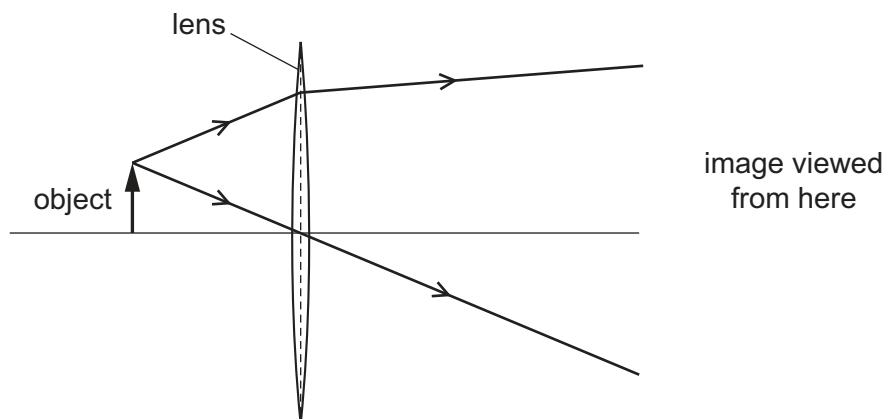


What happens to this ray?

- A It is completely reflected.
 - B It is completely refracted.
 - C It is partially reflected and partially refracted.
 - D It is refracted at an angle of refraction of 90° .
- 33 The diagram shows the paths of two rays from the top of an object.

The rays pass through a thin converging lens.

The image produced is viewed from the position shown.



What type of image is seen?

- A a real image that is larger than the object
- B a real image that is smaller than the object
- C a virtual image that is larger than the object
- D a virtual image that is smaller than the object

- 34 Three objects, P, Q and R, vibrate with the frequencies shown and produce longitudinal waves in the air.

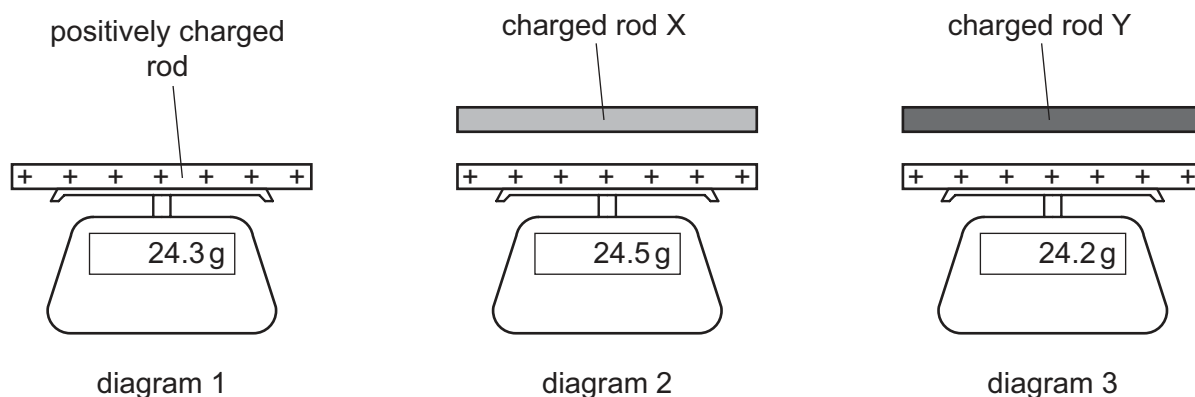
object	frequency/Hz
P	25
Q	1000
R	15000

Which of these waves can be heard by a human with normal hearing?

- A** P, Q and R
B P and Q only
C P and R only
D Q and R only
- 35 A positively charged insulating rod is placed on a balance. The reading on the balance is shown in diagram 1.

Two charged rods X and Y are now brought close to the positively charged rod in turn.

Diagram 2 and diagram 3 show the new reading on the balance in each case.



Which row gives the charges on rod X and rod Y?

	rod X	rod Y
A	negative	negative
B	negative	positive
C	positive	negative
D	positive	positive

- 36 A charger for a mobile phone (cell phone) supplies 50 mA of current to the phone battery for 30 minutes.

How much charge passes through the battery?

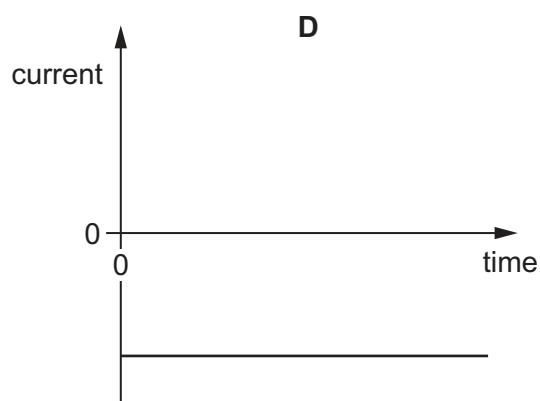
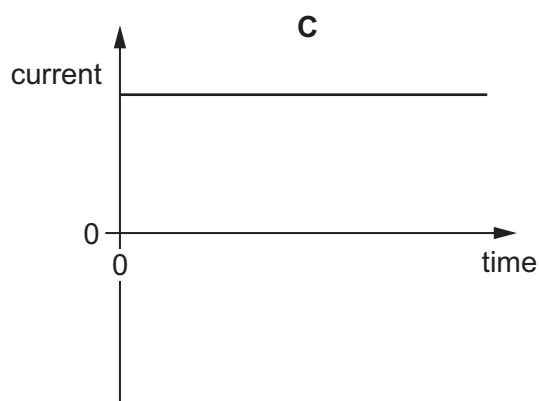
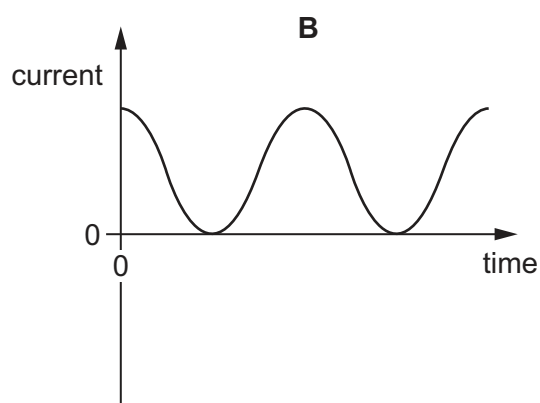
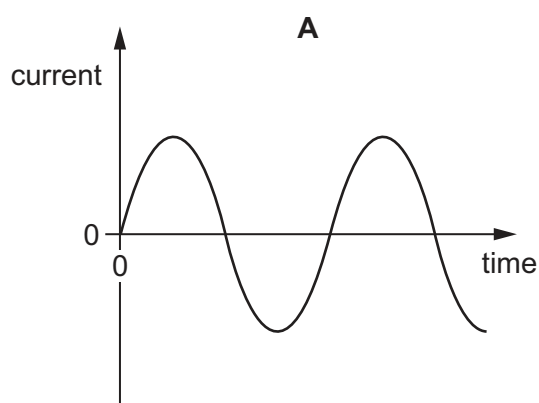
- A 1.5 C B 90 C C 1500 C D 90000 C

- 37 There is a current of 3.0 A in a resistor. The energy converted in the resistor is 540 J in 60 s.

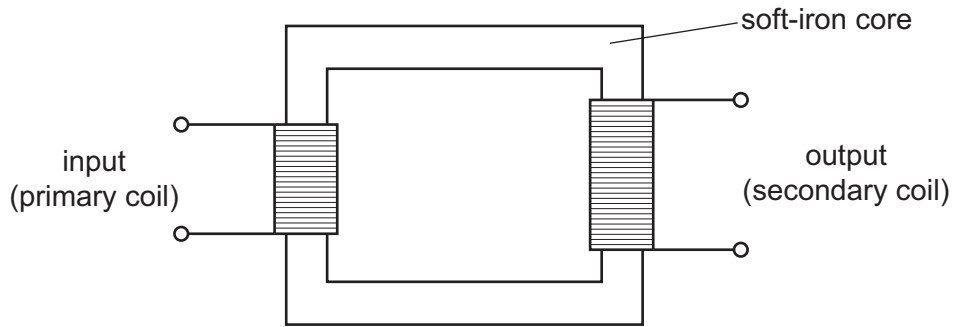
What is the potential difference across the resistor?

- A 1.0 V B 3.0 V C 9.0 V D 180 V

- 38 Which graph represents an alternating current?



39 The diagram represents a transformer.



Why is there an induced electromotive force (e.m.f.) across the secondary coil?

- A There is a changing magnetic field in the soft-iron core.
- B There is a direct current in the primary coil.
- C There is a direct current in the soft-iron core.
- D There is a steady magnetic field in the soft-iron core.

40 The emissions from a radioactive source pass through a sheet of lead, 10 mm thick.

Which row describes other properties of these emissions?

	ionising effect	deflection in an electric field
A	strong	from positive to negative
B	strong	no deflection
C	weak	from positive to negative
D	weak	no deflection

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The Periodic Table of Elements

		Group										
I	II	III	IV	V	VI	VII	VIII					
3 Li lithium 7	4 Be beryllium 9	1 H hydrogen 1	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	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p>Key</p> <p>atomic number</p> <p>atomic symbol</p> <p>name</p> <p>relative atomic mass</p> </div>										
19 K potassium 39	20 Ca calcium 40	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					
37 Rb rubidium 85	38 Sr strontium 88	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84					
55 Cs caesium 133	56 Ba barium 137	30 Zn zinc 65	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	54 Xe xenon 131					
87 Fr francium —	88 Ra radium —	29 Cu copper 64	48 Cd cadmium 112	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	86 Rn radon —					
		26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65						
		25 Mn manganese 55	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108						
		24 Cr chromium 52	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106						
		23 V vanadium 51	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103						
		22 Ti titanium 48	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101						
		21 Sc scandium 45	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —						
		57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186						
		89–103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —						

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 dm³ at room temperature and pressure (r.t.p.).