



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CO-ORDINATED SCIENCES

0654/23

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)

* 0 8 6 1 2 3 8 5 5 8 *

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 20.

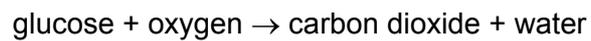
Electronic calculators may be used.

This document consists of **17** printed pages and **3** blank pages.

- 1 What is homeostasis?
- A the maintenance of the body's external environment
 - B the maintenance of the body's internal environment
 - C the processes that produce heat in the body
 - D the removal of wastes from the body

- 2 What is excretion?
- A breakdown of materials in kidney cells
 - B chemical reactions in liver cells
 - C removal of undigested food from the gut
 - D removal of waste products

- 3 Aerobic respiration is summarised below.



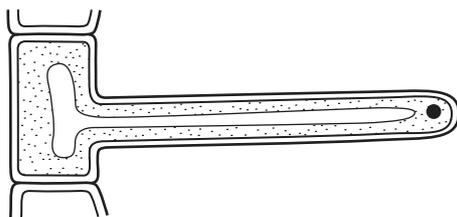
How many molecules of carbon dioxide will be produced from the breakdown of four molecules of glucose?

- A 4 B 8 C 16 D 24

- 4 Which statements about X chromosomes in humans are correct?

	present in body cells in males	present in body cells of females	carry genes
A	✓	✓	✓
B	✓	x	✓
C	✓	x	x
D	x	✓	x

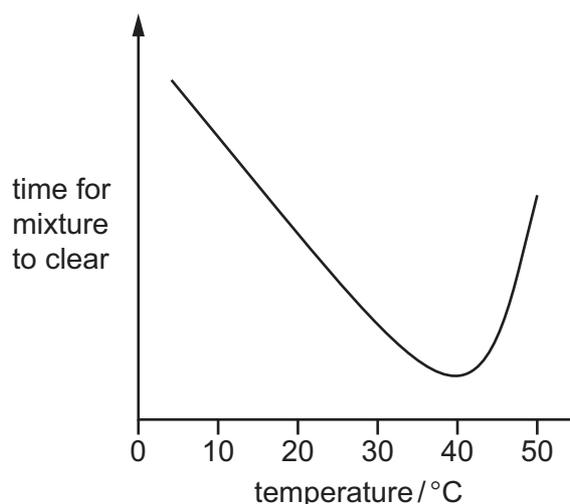
- 5 The diagram shows a section through a root hair cell.



How is the structure of the root hair cell related to its function?

- A** The nucleus is not at the centre of the cell.
B The shape helps to support the plant.
C The surface area is large.
D The volume of the vacuole is small.
- 6 What is meant by fertilisation?
- A** combining of male and female nuclei
B joining of male and female sex organs
C movement of sperms through the uterus to an ovum
D reproduction
- 7 When a suspension of powdered milk is completely digested by a protease enzyme it becomes clear.

The graph shows the time taken for a mixture of protease and powdered milk to clear at different temperatures.



What is this enzyme's optimum temperature?

- A** 5 °C **B** 37 °C **C** 40 °C **D** 50 °C

8 Which row correctly matches the form of malnutrition with its possible outcome?

	form of malnutrition	possible outcome
A	energy intake is greater than energy use	obesity
B	high fat intake	constipation
C	lack of dietary fibre	starvation
D	lack of fat intake	coronary heart disease

9 Which organisms obtain energy directly from every trophic level?

- A** carnivores
- B** decomposers
- C** herbivores
- D** producers

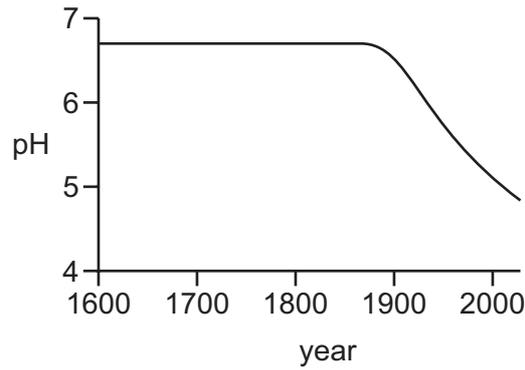
10 In the geotropic and phototropic responses of a plant shoot, does the shoot grow towards or away from the stimulus?

	geotropism	phototropism
A	away from	away from
B	away from	towards
C	towards	away from
D	towards	towards

11 Which part of a seed is **not** part of a plant embryo?

- A** cotyledon
- B** plumule
- C** radicle
- D** testa

12 The graph shows how the pH of a lake has changed from 1600 to 2000.



What would have contributed to the change from 1900 onwards?

- A burning of coal in nearby power stations
 - B increasing global temperatures
 - C increased growth of algae in the lake
 - D the use of pesticides on nearby fields
- 13 In a species of plant, the allele for yellow flowers is dominant to the allele for red flowers.

Two heterozygous yellow-flowered plants are crossed.

Which offspring are produced?

- A 25% with yellow flowers, 75% with red flowers
 - B 50% with yellow flowers, 50% with red flowers
 - C 75% with yellow flowers, 25% with red flowers
 - D 100% with yellow flowers
- 14 Which row describes the melting point and boiling point of salt water?

	melting point/°C	boiling point/°C
A	0	less than 100
B	0	100
C	less than 0	more than 100
D	more than 0	100

15 When solid zinc carbonate is heated, a different solid and a gas are formed.

Which type of change occurs?

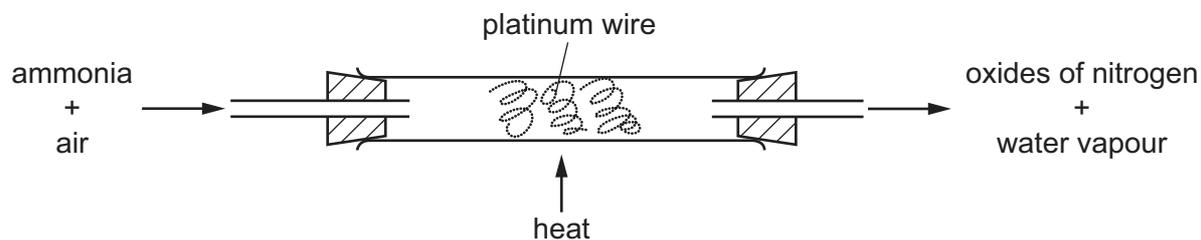
- A chemical
- B exothermic
- C physical
- D separation

16 Dilute hydrochloric acid is added to aqueous sodium hydroxide in a non-insulated beaker. The temperature of the mixture increases.

Which statement is **not** correct?

- A The reaction is exothermic.
- B There is a reduction in the amount of chemical energy.
- C There is an increase in the amount of thermal energy.
- D There is no energy loss from the mixture.

17 Ammonia is oxidised as shown.

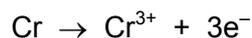


The platinum is chemically unchanged at the end of the reaction.

What is the reason for using platinum?

- A to absorb the heat from the reaction
- B to filter out oxygen from the air
- C to increase the rate of the reaction
- D to neutralise the ammonia

18 The ionic equation for the formation of chromium(III) ions is shown.



Which statement about chromium atoms is correct?

- A They are oxidised by gaining electrons.
- B They are oxidised by losing electrons.
- C They are reduced by gaining electrons.
- D They are reduced by losing electrons.

19 Which substances react with dilute sulfuric acid to form a salt?

	magnesium	magnesium oxide	magnesium carbonate	magnesium chloride
A	✓	✓	✓	x
B	✓	✓	x	✓
C	✓	x	✓	✓
D	x	✓	✓	✓

20 Element X has two outer-shell electrons.

Element Y has seven outer-shell electrons.

Which statement about X and Y is **not** correct?

- A Element X combines with element Y to form an ionic compound.
- B Element X combines with element Y to form a solid compound which conducts electricity.
- C Element X conducts electricity and element Y is in Group VII of the Periodic Table.
- D Element X is in Group II of the Periodic Table and element Y does not conduct electricity.

21 The melting points of three elements in Group I and of three elements in Group VII are shown.

element	group	melting point (°C)
lithium	I	179
sodium	I	98
potassium	I	64
chlorine	VII	-101
bromine	VII	-7
iodine	VII	114

What is the trend in reactivity in each group as melting point increases?

	change in Group I reactivity	change in Group VII reactivity
A	less reactive	less reactive
B	less reactive	more reactive
C	more reactive	less reactive
D	more reactive	more reactive

22 Underwater pipes made from steel are prevented from rusting by sacrificial protection.

Sacrificial protection uses a1..... reactive metal attached to the pipes which is2..... in preference to the steel.

Which words complete gaps 1 and 2?

	1	2
A	less	oxidised
B	less	reduced
C	more	oxidised
D	more	reduced

23 Which row describes how hydrogen and nitrogen are obtained for use in the Haber process?

	hydrogen	nitrogen
A	electrolysis of sulfuric acid	catalytic reduction of nitrogen oxides
B	electrolysis of sulfuric acid	distillation of air
C	reaction of methane and steam	catalytic reduction of nitrogen oxides
D	reaction of methane and steam	distillation of air

24 In the Contact process, sulfur trioxide is absorbed by concentrated sulfuric acid and then diluted with water.

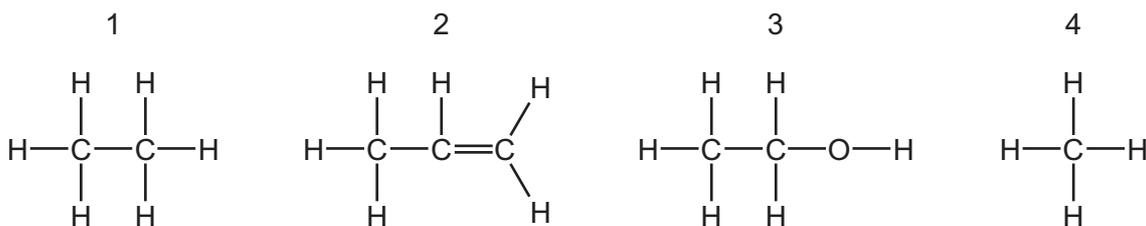
Which statement about the reaction between sulfur trioxide and water explains why sulfur trioxide is **not** dissolved directly in water?

- A** A catalyst is required.
- B** It is a slow reaction.
- C** It is endothermic and produces a sulfuric acid mist.
- D** It is exothermic and produces a sulfuric acid mist.

25 Which word equation describes the manufacture of lime from limestone?

- A** calcium carbonate \rightarrow calcium hydroxide + carbon dioxide
- B** calcium carbonate \rightarrow calcium oxide + carbon dioxide
- C** calcium hydroxide \rightarrow calcium oxide + water
- D** calcium oxide + carbon dioxide \rightarrow calcium carbonate

26 The structures of four compounds are shown.



Which types of compound do these structures represent?

	1	2	3	4
A	alcohol	alkene	alkane	alcohol
B	alkane	alcohol	alkene	alkane
C	alkane	alkene	alcohol	alkane
D	alkene	alkane	alcohol	alkene

27 Which process is used to make ethanol?

- A** Addition of oxygen to ethene in the presence of a catalyst.
- B** Addition of oxygen to ethene with no catalyst.
- C** Addition of steam to ethene in the presence of a catalyst.
- D** Addition of steam to ethene with no catalyst.

28 A car moves with a constant speed of 15 m/s along a road for 20 s.

After this, the car is 100 m from where it started, measured in a straight line.

Which statement about the car is correct?

- A** It has travelled a distance of 100 m along the road.
- B** It has travelled a distance of 300 m along the road.
- C** Its direction was constant.
- D** Its velocity was constant.

29 A worker carries bricks up a ladder.

The following quantities are known.

- the height the bricks are lifted up
- the time taken for the worker to lift the bricks
- the volume of the bricks
- the weight of the bricks

Which quantities are needed to calculate the useful power produced by the worker as he carries the bricks up the ladder?

- A** height, time and volume
B height, time and weight
C height, volume and weight
D time, volume and weight

30 The pressure P of a fixed mass of gas at constant temperature depends on its volume V .

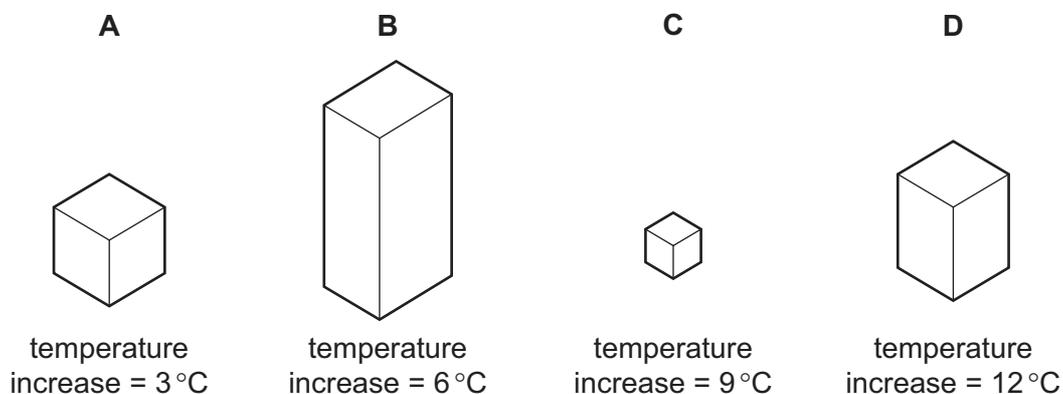
What is the relationship between P and V ?

- A** P is directly proportional to V .
B P is directly proportional to V^2 .
C P is inversely proportional to V .
D P is inversely proportional to V^2 .

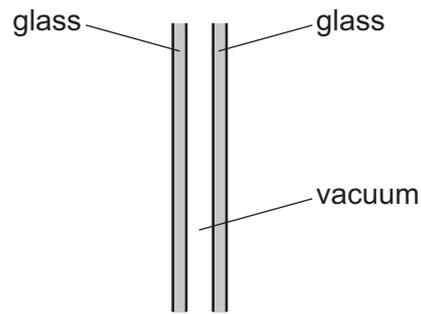
31 Four blocks are made from different materials. The blocks are heated and the thermal energy of each block increases by the same amount.

The temperature increase of each block is shown in the diagrams.

Which block has the smallest thermal capacity?

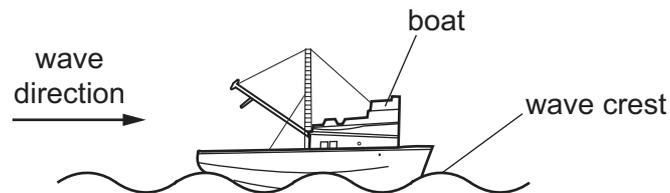


32 One type of double glazing consists of two panes of glass separated by a vacuum.



Which methods of energy transfer are prevented by the vacuum?

- A conduction and convection only
 - B conduction and radiation only
 - C convection and radiation only
 - D conduction, convection and radiation
- 33 A water wave travels at a steady speed of 4.0 m/s and passes a stationary boat.



Four wave crests pass the boat every 2.0 seconds.

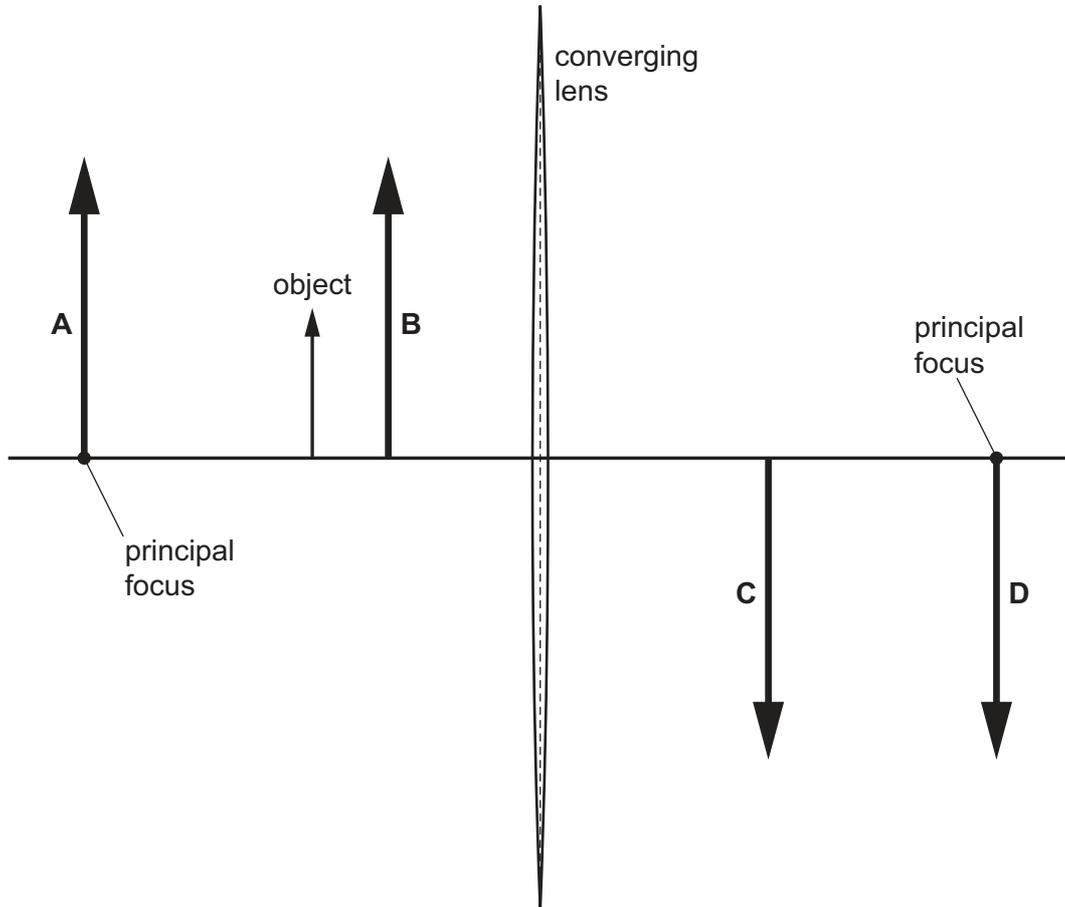
What is the wavelength of the waves?

- A 0.5 m
- B 1.0 m
- C 2.0 m
- D 8.0 m

- 34 A student uses a converging lens to obtain a magnified, virtual image of an object. The object is in the position shown in the diagram.

A principal focus of the lens is also shown on each side of the lens.

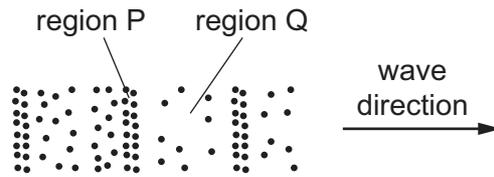
At which labelled position is the image formed?



- 35 Which radiations are included in the electromagnetic spectrum?

- A α -particle radiation and β -particle radiation
- B α -particle radiation and γ -rays
- C β -particle radiation and infra-red radiation
- D γ -rays and infra-red radiation

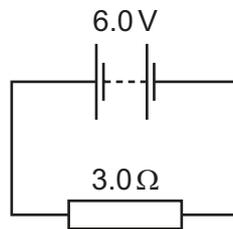
- 36 The diagram represents a wave in air. Molecules are closer together in region P than they are in region Q.



Which type of wave is represented, and in which direction do the molecules vibrate?

	type of wave	direction of vibration
A	longitudinal	\longleftrightarrow
B	longitudinal	\updownarrow
C	transverse	\longleftrightarrow
D	transverse	\updownarrow

- 37 The diagram shows a $3.0\ \Omega$ resistor connected to a $6.0\ \text{V}$ battery.

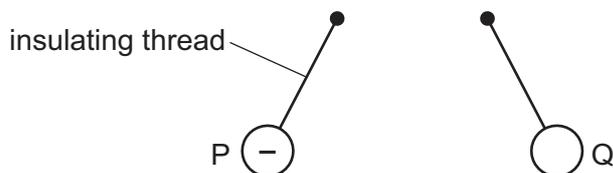


How much energy is transferred in the $3.0\ \Omega$ resistor in 30 seconds?

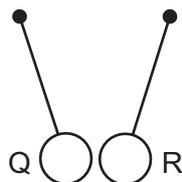
- A** 15 J **B** 60 J **C** 360 J **D** 540 J

- 38 Three charged balls P, Q and R are suspended by insulating threads. Ball P is negatively charged.

Ball Q is brought close to ball P. The balls move away from each other.



Ball Q is now brought close to ball R. The balls move closer to each other.



What are the signs of the charges on ball Q and ball R?

	ball Q	ball R
A	negative	negative
B	negative	positive
C	positive	negative
D	positive	positive

- 39 An engineer wishes to make a d.c. circuit that will switch on a lamp automatically at night.

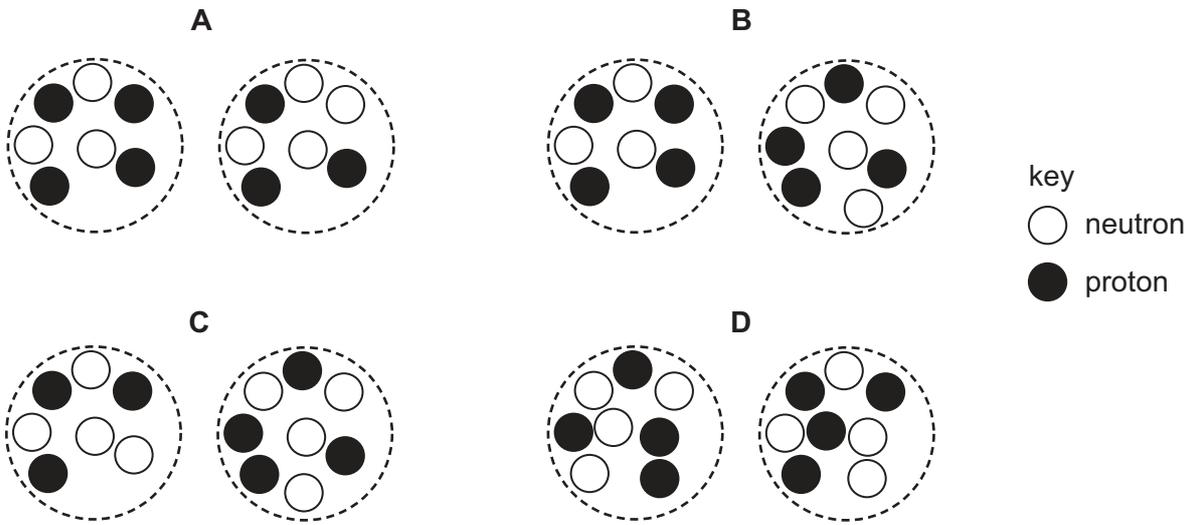
She uses a light-dependent resistor (LDR) in the circuit, and a component that allows a large current to be controlled by a small current.

What happens to the resistance of the LDR as it becomes dark, and what is a suitable component to allow a large current to be controlled by a small current?

	resistance of LDR	suitable component
A	decreases	relay
B	decreases	transformer
C	increases	relay
D	increases	transformer

40 The diagrams represent pairs of nuclei of some atoms.

Which pair shows nuclei of different isotopes of the same element?



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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	5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20					2 He helium 4						
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					36 Kr krypton 84						
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	86 Rn radon —
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

1	H	hydrogen	1
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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.).