Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

CO-ORDINATED SCIENCES **0973/21**

Paper 2 Multiple Choice (Extended) **May/June 2023**

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 What is meant by respiration?

A protein synthesis

B sweating to lose heat

C the function of lungs

D the release of energy

2 What is meant by osmosis?

A the net movement of water molecules from a region of higher water potential to a region of lower water potential through a cell wall

B the net movement of water molecules from a region of higher water potential to a region of lower water potential through a partially permeable membrane

C the net movement of water molecules from a region of lower water potential to a region of higher water potential through a cell wall

D the net movement of water molecules from a region of lower water potential to a region of higher water potential through a partially permeable membrane

3 Linoleic acid is a fatty acid.

Which larger molecule may contain linoleic acid?

A glycogen

B oil

C protein

D starch

4 Which row about enzymes is correct?

	each enzyme catalyses many different reactions	the active site is the part of the enzyme where the substrate binds	enzymes are complex carbohydrates	enzymes are denatured at their optimum temperature	enzymes can work outside of cells
A	✓	✓	✗	✗	✗
B	✓	✗	✓	✗	✓
C	✗	✓	✗	✗	✓
D	✗	✓	✓	✓	✗

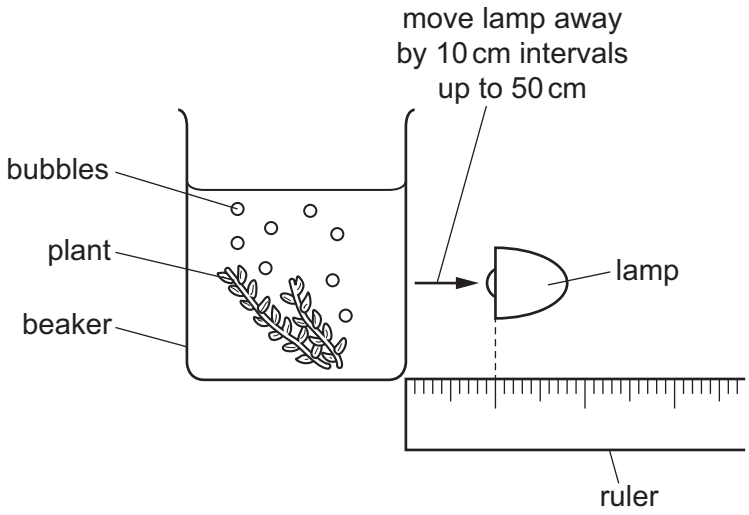
key

✓ = true

✗ = false

5 An experiment is set up to investigate the effect of changing the light intensity on the rate of photosynthesis.

The lamp is moved in 10 cm intervals away from the plant and the number of bubbles of gas recorded in 60 seconds.



What will be the result of moving the lamp further away from the beaker containing the plant?

A The number of bubbles of carbon dioxide will decrease.

B The number of bubbles of carbon dioxide will increase.

C The number of bubbles of oxygen will decrease.

D The number of bubbles of oxygen will increase.

6 Some processes that occur in the alimentary canal and associated organs are listed.

1 absorption

2 assimilation

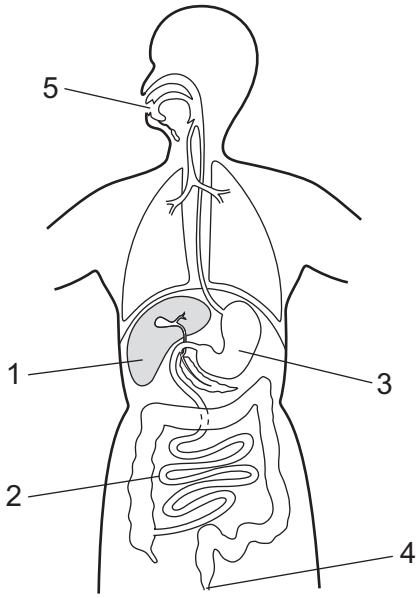
3 digestion

4 egestion

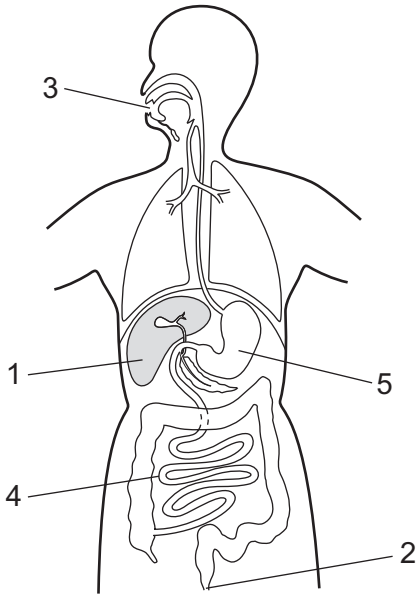
5 ingestion

Which diagram correctly links each process to the part of the alimentary canal or associated organs?

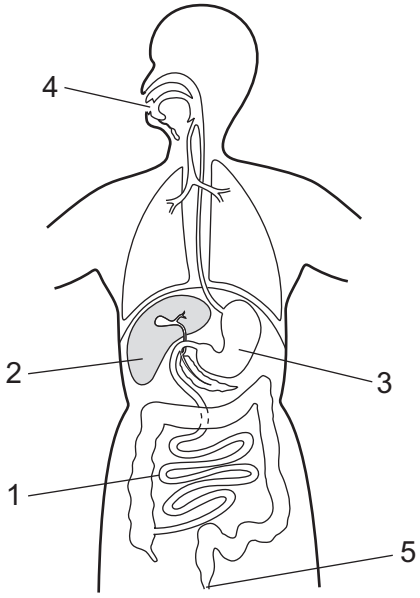
A



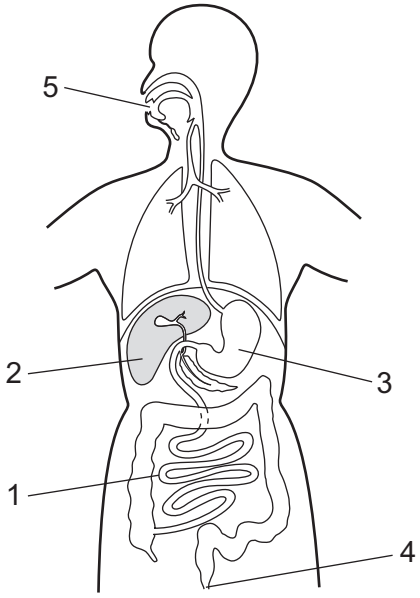
B



C



D



7 What is the sequence of blood vessels that a red blood cell passes through as it travels from the vena cava to the kidney?

A pulmonary artery → pulmonary vein → aorta → renal artery

B pulmonary artery → pulmonary vein → aorta → renal vein

C pulmonary vein → pulmonary artery → aorta → renal artery

D pulmonary vein → pulmonary artery → aorta → renal vein

8 Which statement about anaerobic respiration is correct?

A It does not cause an oxygen debt.

B It occurs in the muscles during vigorous exercise.

C It uses oxygen to release energy from nutrient molecules.

D It releases more energy per glucose molecule compared to aerobic respiration.

9 What is the function of the cornea?

A It carries impulses to the brain.

B It controls how much light enters the pupil.

C It focuses light onto the retina.

D It refracts light.

10 In a plant, what leads to offspring that are genetically identical to the parent?

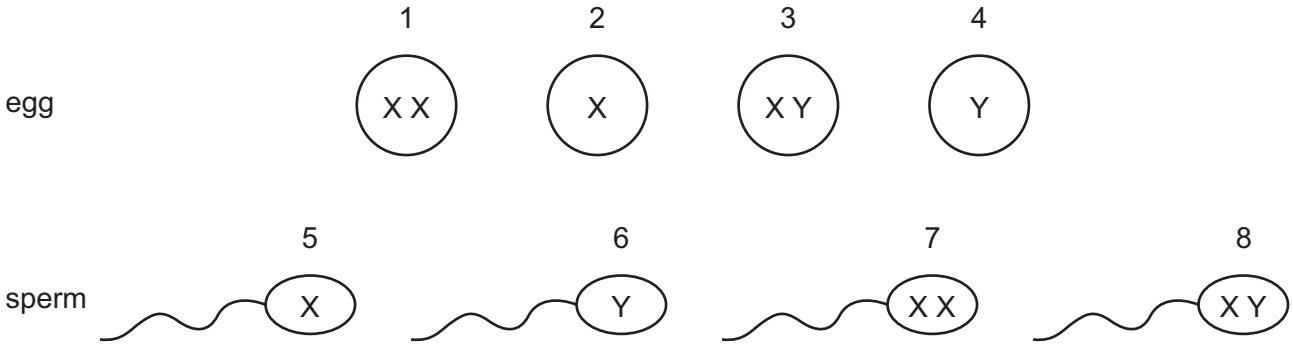
A asexual reproduction

B insect pollination

C seed germination

D sexual reproduction

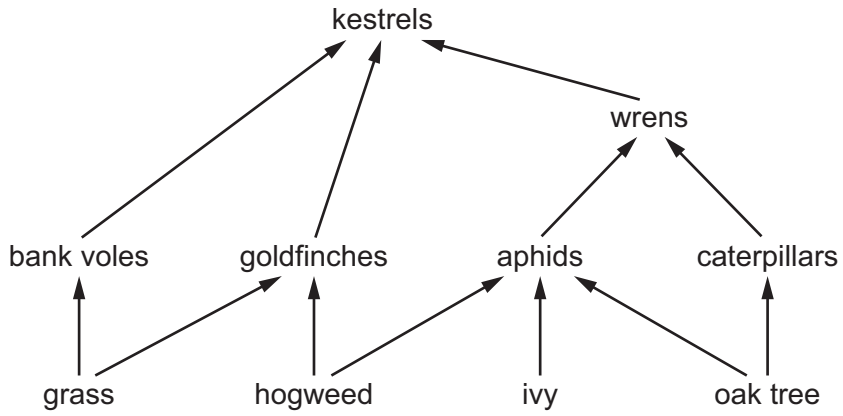
11 The diagram shows eggs and sperm containing sex chromosomes.



Which row gives the correct combination of sex chromosomes for a male and female offspring?

	male offspring	female offspring
A	1 and 8	3 and 7
B	2 and 6	2 and 5
C	3 and 8	1 and 7
D	4 and 6	2 and 5

12 The diagram shows a food web.



How many primary consumers, secondary consumers, tertiary consumers and quaternary consumers are present?

	primary	secondary	tertiary	quaternary
A	1	1	4	4
B	2	4	2	0
C	4	2	1	0
D	4	4	1	1

13 What causes eutrophication?

A combustion of fossil fuels

B cutting down of forests

C discarded plastic rubbish

D overuse of nitrogen-containing fertiliser

14 An aqueous salt solution contains an insoluble impurity.

Which processes are used to obtain pure salt crystals?

A distillation then crystallisation

B distillation then chromatography

C filtration then crystallisation

D filtration then chromatography

15 The element phosphorus burns in air, as shown.

$$4P + 5O_2 \rightarrow P_4O_{10}$$

What does the formula P_4O_{10} show?

A a mixture of atoms of two elements

B a mixture of molecules of two elements

C a molecule of a compound

D an atom of a compound

16 Which row describes an atom that has the nucleon number 24?

	number of protons	number of neutrons	number of electrons
A	8	8	8
B	12	12	12
C	21	24	21
D	24	28	24

17 Which symbol equation is **not** balanced?

A $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

B $Fe_3O_4 + 2H_2 \rightarrow 3Fe + 2H_2O$

C $Mg(OH)_2 + 2HCl \rightarrow MgCl_2 + 2H_2O$

D $2Na + 2H_2O \rightarrow 2NaOH + H_2$

18 Sodium hydroxide is manufactured by the electrolysis of concentrated aqueous sodium chloride.

During the process, a gas is given off at each electrode and the aqueous sodium hydroxide collects around one of the electrodes.

Which row identifies the gas at each electrode and the electrode around which the aqueous sodium hydroxide collects?

	at the anode	at the cathode	electrode at which sodium hydroxide collects
A	chlorine	hydrogen	cathode
B	chlorine	hydrogen	anode
C	oxygen	chlorine	cathode
D	oxygen	chlorine	anode

19 Which row explains why increasing the concentration of a reactant increases the rate of reaction?

	proportion of particles with the minimum energy to react	collision frequency between reacting particles
A	increases	increases
B	increases	stays the same
C	stays the same	increases
D	stays the same	stays the same

20 Which statements about neutralisation are correct?

1 Acids and bases produce water when they neutralise each other.

2 During neutralisation, bases transfer protons to acids.

3 Neutral solutions turn universal indicator green.

4 During neutralisation, acids transfer hydroxide ions to bases.

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

21 The properties of some substances are listed.

1 form acidic oxides

2 have high melting points

3 act as catalysts

4 form coloured compounds

What are the properties of transition metals?

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

22 Which atmospheric pollutant is removed from air by lime?

A ammonia

B carbon monoxide

C hydrocarbons

D sulfur dioxide

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 Equations representing reactions in the Contact process are listed.

reaction 1 $S + O_2 \rightarrow SO_2$

reaction 2 $2SO_2 + O_2 \rightleftharpoons 2SO_3$

reaction 3 $H_2SO_4 + SO_3 \rightarrow H_2S_2O_7$

reaction 4 $H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$

Which row identifies the reactions that use the stated conditions?

	requires a vanadium(V) oxide catalyst	requires a temperature of 450 °C	requires a pressure of 2 atmospheres
A	reaction 2	reaction 1	reaction 4
B	reaction 2	reaction 2	reaction 2
C	reaction 3	reaction 1	reaction 2
D	reaction 3	reaction 2	reaction 4

25 Which statements about limestone are correct?

1 Its main constituent is calcium oxide.

2 It can be used to manufacture lime.

3 It thermally decomposes to release carbon dioxide.

4 It is used to neutralise alkaline soils.

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

26 Petroleum is separated into fractions by fractional distillation.

Information about uses of some fractions and positions in the fractionating column where they are collected is shown.

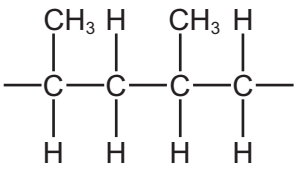
	fraction	use	position
1	gasoline	making roads	below refinery gas
2	bitumen	petrol for car engines	bottom of column
3	naphtha	making chemicals	below gasoline
4	refinery gas	heating and cooking	top of column

Which rows are correct?

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

27 Which structure represents the addition polymer made from the monomer propene, C_3H_6?

A



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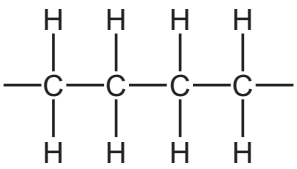

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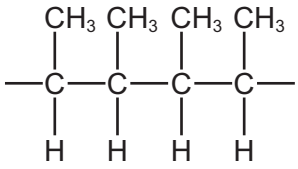

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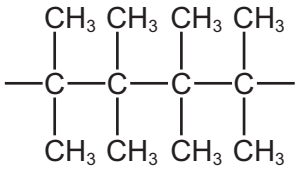
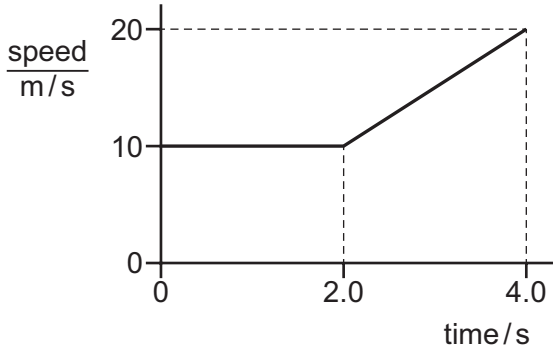


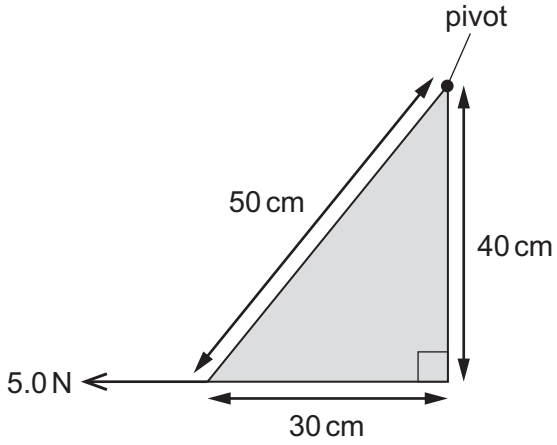
28 The diagram shows the speed–time graph for a moving object.



What is the distance travelled by the object in 4.0 s?

A 30 m **B** 40 m **C** 50 m **D** 80 m

29 The diagram shows a triangular sheet of metal with sides of length 50 cm, 40 cm and 30 cm. The sheet is free to move about a pivot at the top corner, as shown.



A cord is attached to the bottom left corner of the sheet and pulled with a horizontal force of 5.0 N to the left.

What is the moment of the 5.0 N force about the pivot?

A 150 N cm **B** 200 N cm **C** 250 N cm **D** 600 N cm

30 A machine has useful output energy of 1000 J and wasted energy of 300 J.

Which expression is used to calculate the efficiency of the machine?

A $\frac{300}{1000 + 300} \times 100\%$

B $\frac{300}{1000} \times 100\%$

C $\frac{1000 - 300}{1000} \times 100\%$

D $\frac{1000}{1000 + 300} \times 100\%$

31 Which statement about thermal radiation is correct?

A A dull surface is a good absorber and a good reflector of thermal radiation.

B A dull surface is a poor absorber and a poor reflector of thermal radiation.

C A shiny surface is a good absorber but a poor reflector of thermal radiation.

D A shiny surface is a poor absorber but a good reflector of thermal radiation.

32 A student stands in front of a plane mirror on a wall.

Which statement about the image of the student is **not** correct?

A The image is laterally inverted (left to right).

B The image is smaller than the student.

C The image is upright.

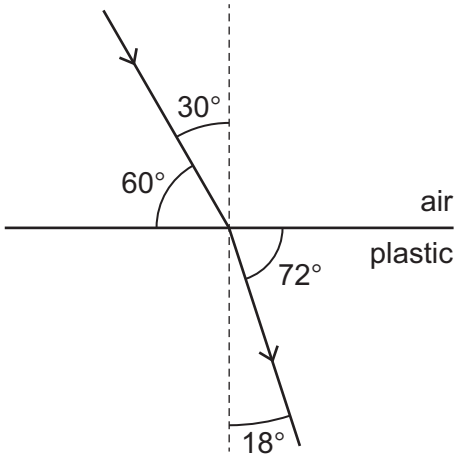
D The student and the image are equal distances from the mirror.

33 A wave has a frequency of 3.0 MHz and a speed of 1500 m / s.

What is the wavelength of the wave?

A 5.0×10^{-4} m **B** 0.50 m **C** 500 m **D** 4500 m

34 The diagram shows a ray of light passing from air into plastic. The sizes of four angles are given.



The table gives the value of the sine of each angle.

angle / °	sine
18	0.31
30	0.50
60	0.87
72	0.95

What is the refractive index of the plastic?

A 0.62 **B** 0.92 **C** 1.6 **D** 1.7

35 Two insulators are charged by rubbing them with a cloth.

After this, the charged insulators repel each other.

Which statement is a possible description of how the insulators become charged?

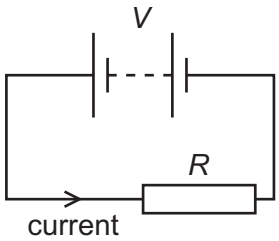
A One gained electrons and the other gained protons.

B One gained electrons and the other lost electrons.

C They both lost electrons.

D They both lost protons.

36 A battery of e.m.f. *V* is connected across a resistor of resistance *R*. There is a current in the resistor.



Which row shows two changes that **both** increase the current in the resistor?

	change 1	change 2
A	decrease *V*	decrease *R*
B	decrease *V*	increase *R*
C	increase *V*	decrease *R*
D	increase *V*	increase *R*

37 An electric kettle is connected to a 250 V supply. The current in the heating element of the kettle is 10 A.

How much electrical energy is transferred in 3.0 minutes?

A 75 J **B** 4500 J **C** 7500 J **D** 450 000 J

38 Fuses are used in domestic electric circuits.

Which statement about fuses is correct?

A A fuse is connected in the live wire.

B A fuse is connected in the neutral wire.

C A 3.0 A fuse produces a current of exactly 3.0 A in the circuit.

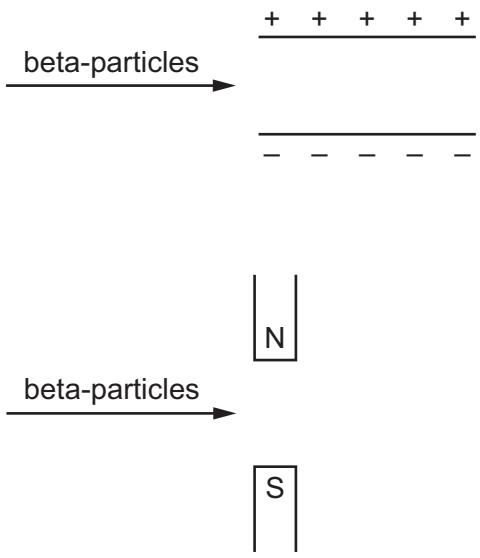
D A 3.0 A fuse produces a minimum current of 3.0 A in the circuit.

39 A radioactive nucleus $^{238}_{92}U$ decays into a thorium (Th) nucleus by emitting an alpha-particle.

What is the symbol for the thorium nucleus formed?

A $^{234}_{90}Th$ **B** $^{234}_{92}Th$ **C** $^{238}_{90}Th$ **D** $^{238}_{92}Th$

40 The diagrams show a beam of beta-particles passing into an electric field and another beam of beta-particles passing into a magnetic field.



In which direction is the beam deflected in each case?

	electric field	magnetic field
A	towards the negative plate	into the page
B	towards the negative plate	out of the page
C	towards the positive plate	into the page
D	towards the positive plate	out of the page

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.).