



**Cambridge Assessment International Education**  
Cambridge International General Certificate of Secondary Education

---

**COMBINED SCIENCE**

**0653/21**

Paper 2 Multiple Choice (Extended)

**October/November 2019**

**45 minutes**

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

\* 8 5 8 4 5 3 7 5 5 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.

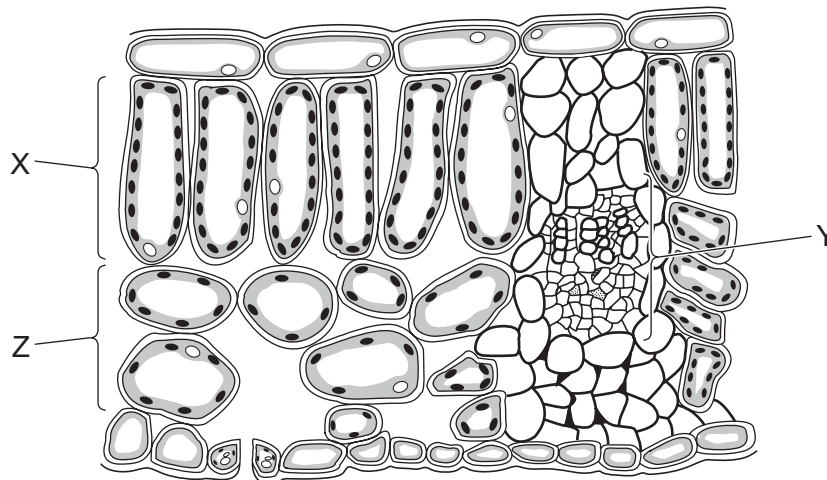
2

1 A biologist keeps a potted plant in a laboratory.

Which feature of the potted plant shows that it is a living organism?

- A It grows larger over time.
- B It has green leaves.
- C The compost in the pot dries after he waters it.
- D The stems contain xylem.

2 The diagram shows a section through a leaf.



Which row correctly identifies the labelled parts of the leaf section?

	X	Y	Z
<b>A</b>	cuticle	vascular bundle	palisade mesophyll
<b>B</b>	palisade mesophyll	vascular bundle	spongy mesophyll
<b>C</b>	palisade mesophyll	cuticle	spongy mesophyll
<b>D</b>	spongy mesophyll	cuticle	vascular bundle

3

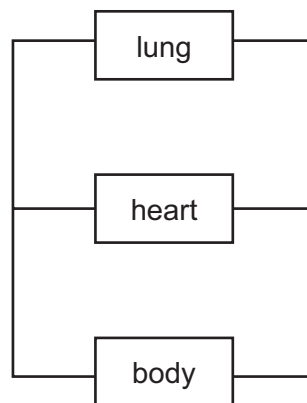
- 3 1 cm<sup>3</sup> of substance **X** is added to 10 cm<sup>3</sup> starch suspension and mixed. Food tests are carried out immediately after mixing and again after an hour.

The results of the tests are shown in the table.

test reagent	colour of solution after mixing	colour of solution after one hour
Benedict's solution	blue	orange
iodine solution	blue / black	brown

What is substance **X**?

- A** amylase  
**B** protease  
**C** lipase  
**D** sugar
- 4 How are root hair cells adapted for absorption of water?
- A** large surface area  
**B** thick cell wall  
**C** many chloroplasts  
**D** no nucleus
- 5 The diagram shows a double circulatory system.



In which direction does the blood flow in this type of system?

- A** heart → body → heart → lung  
**B** body → heart → body → lung  
**C** heart → body → lung → heart  
**D** lung → heart → lung → body

- 6 The concentrations of carbon dioxide and oxygen in expired air differ from the concentrations in inspired air.

	gas	concentration in expired air
1	carbon dioxide	higher
2	carbon dioxide	lower
3	oxygen	higher
4	oxygen	lower

Which rows correctly show the difference?

- A** 1 and 3      **B** 1 and 4      **C** 2 and 3      **D** 2 and 4
- 7 Which statement about aerobic respiration is correct?
- A** It exchanges gases through the walls of the alveoli.  
**B** It expels carbon dioxide from the lungs.  
**C** It only produces carbon dioxide and energy.  
**D** It uses oxygen to release energy from glucose.

- 8 What is the effect of adrenaline on the rate of breathing and pulse rate?

	rate of breathing	pulse rate
<b>A</b>	decreases	decreases
<b>B</b>	decreases	increases
<b>C</b>	increases	decreases
<b>D</b>	increases	increases

- 9 Auxins are produced in the tip of a shoot.

In an experiment, auxin was applied to a plant shoot just below its tip.

Which row describes the change to the shoot and explains this change?

	shoot	explanation
<b>A</b>	becomes longer	cells divide
<b>B</b>	becomes longer	cells elongate
<b>C</b>	becomes longer	cells elongate and then divide
<b>D</b>	did not change length	the auxin has no effect

10 Which statement about sexual reproduction is **always** correct?

- A It involves only one parent.
- B It involves the fusion of nuclei.
- C It produces genetically identical offspring.
- D It takes place only in animals.

11 The table gives comparisons between insect-pollinated and wind-pollinated flowers.

Which row is correct?

	surface of stigma		surface of pollen	
	insect	wind	insect	wind
<b>A</b>	feathery	sticky	smooth	spiky
<b>B</b>	feathery	sticky	spiky	smooth
<b>C</b>	sticky	feathery	smooth	spiky
<b>D</b>	sticky	feathery	spiky	smooth

12 The following are adaptive features of some gametes.

- 1 a flagellum
- 2 a jelly coat
- 3 a sac of enzymes at one end
- 4 a store of energy

Which are features of a human male gamete?

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

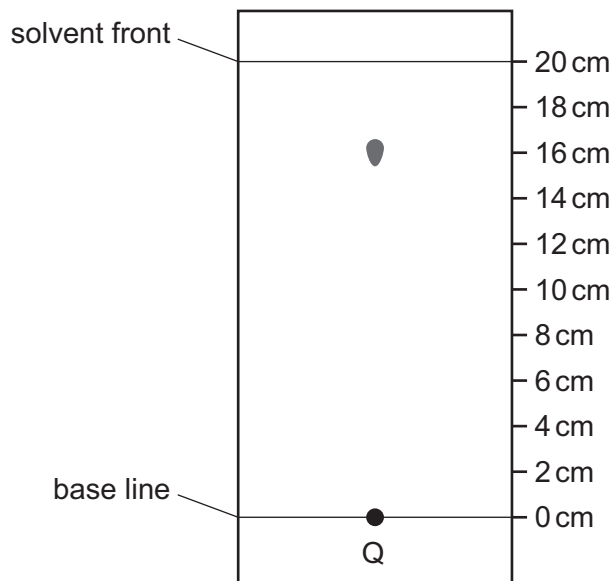
13 An increased volume of nitrate ions is washed into a lake.

Why does this result in a decrease in the number of fish in the lake?

- A There is a decrease in the decomposition of producers.
- B There is a decrease in the growth of producers.
- C There is an increase in aerobic respiration by decomposers.
- D There is an increase in dissolved oxygen.

6

14 A chromatogram of substance Q is shown.



What is the  $R_f$  value of Q?

- A** 0.2                      **B** 0.4                      **C** 0.8                      **D** 1.6

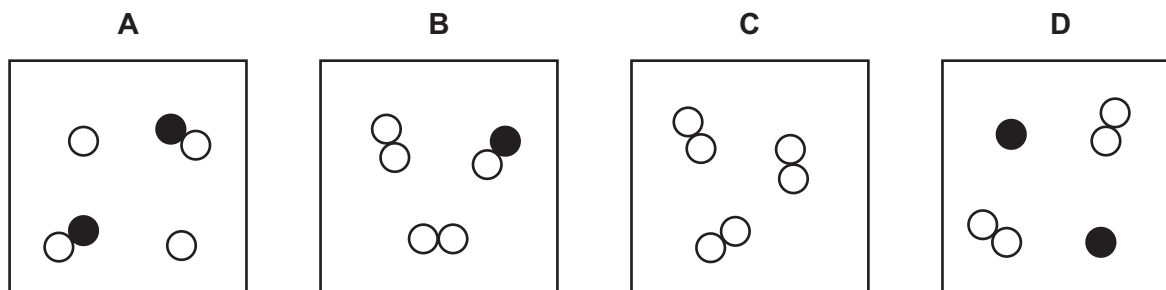
15 Four processes are listed.

- 1 melting of ice
- 2 electrolysis of molten lead(II) bromide
- 3 combustion of carbon
- 4 rusting of iron

Which processes are chemical changes?

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

16 Which diagram represents a mixture of two different elements?



17 The fertiliser ammonium sulfate has the formula  $(\text{NH}_4)_2\text{SO}_4$ .

How many atoms of each element are present in the formula?

	number of hydrogen atoms	number of nitrogen atoms	number of oxygen atoms	number of sulfur atoms
<b>A</b>	4	1	1	1
<b>B</b>	4	2	4	1
<b>C</b>	8	1	4	1
<b>D</b>	8	2	4	1

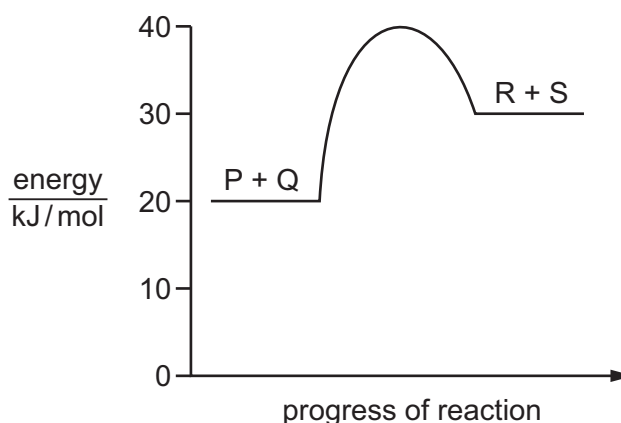
18 Element X is a non-metal used in the treatment of the water supply.

It is made during the electrolysis of a metal salt.

What is the colour of X and at which electrode is it made?

	colour	electrode
<b>A</b>	red	anode
<b>B</b>	red	cathode
<b>C</b>	yellow-green	anode
<b>D</b>	yellow-green	cathode

19 The energy level diagram for the reaction between P and Q to produce R and S is shown.



Which statement about this reaction is correct?

- A** Energy is required to form new bonds.
- B** The activation energy is 10 kJ/mol.
- C** The energy required to break bonds is greater than the energy given out when bonds form.
- D** The reaction is exothermic because the energy of the products is greater than the energy of the reactants.

20 Calcium carbonate reacts with dilute hydrochloric acid.

The time taken to collect 10 cm<sup>3</sup> of carbon dioxide is recorded.

The experiment is repeated at a different temperature. The results are shown.

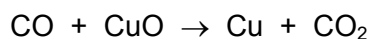
experiment	temperature /°C	time taken /s
1	20	55
2	80	30

The rate of reaction in each experiment is different.

Which statement about the rate of reaction of experiment 1, compared with experiment 2, is correct?

- A It is greater because at the lower temperature the particles move more slowly so they have more time to react.
- B It is greater because the particles collide more frequently.
- C It is lower because the particles collide at the same frequency and fewer of them have the minimum energy to react.
- D It is lower because the particles collide less frequently and fewer of them have the minimum energy to react.

21 The equation for the reaction of carbon monoxide with copper oxide is shown.



Which statement about this reaction is **not** correct?

- A Carbon dioxide is the oxidising agent.
- B Carbon monoxide is the reducing agent.
- C Carbon monoxide is being oxidised.
- D Copper oxide is the oxidising agent.

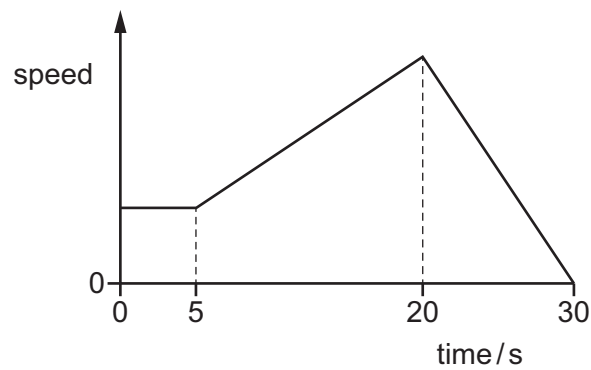
22 Which two substances are used to make copper sulfate?

- A copper and dilute sulfuric acid
- B copper and sulfur
- C copper oxide and dilute sulfuric acid
- D copper oxide and sulfur



- 23 Which statement about elements in the Periodic Table is **not** correct?
- A Elements in Group I react by gaining electrons to form ions.
  - B Elements in Group II have two electrons in their outer shell.
  - C Elements in Group VIII are unreactive because they have full outer shells of electrons.
  - D Elements with seven outer shell electrons are non-metals.
- 24 Which statement about alloys is correct?
- A They are made from metals because metals are poor electrical conductors.
  - B They are mixtures of compounds that contain metals.
  - C They have all the same properties as the metals from which they are made.
  - D They have different properties to the metals from which they are made.
- 25 Which gas is **not** present in clean air?
- A carbon monoxide
  - B neon
  - C nitrogen
  - D water vapour
- 26 Which two gases cause an enhanced greenhouse effect when their concentrations in the atmosphere increase?
- A carbon monoxide and carbon dioxide
  - B carbon dioxide and methane
  - C methane and sulfur dioxide
  - D sulfur dioxide and carbon monoxide
- 27 Which statement about fractions obtained from petroleum is **not** correct?
- A Different fractions have different boiling points.
  - B Gasoline contains molecules of only one hydrocarbon.
  - C Molecules in diesel oil are smaller than molecules in bitumen.
  - D Naphtha is used as a feedstock for making chemicals.

- 28 The graph shows how the speed of a car changes with time. The car travels at constant speed, then accelerates, and finally brakes to a stop.



The car travels 60 m while it brakes to a stop.

What is the average speed of the car while it is braking?

- A** 3.0 m/s      **B** 4.0 m/s      **C** 6.0 m/s      **D** 12 m/s
- 29 The gravitational field strength on Mars is less than that on Earth.

An object is taken from Earth to Mars.

Which statement describes the object when it is on Mars?

- A** It has greater mass than on Earth.  
**B** It has less mass than on Earth.  
**C** It has less weight than on Earth.  
**D** It has the same weight as on Earth.

- 30** A student wants to determine the density of an irregularly shaped stone. He has a measuring cylinder, water, a balance and a thermometer.

These are his measurements:

- P initial volume of water in measuring cylinder
- Q mass of measuring cylinder
- R mass of stone
- S mass of water in measuring cylinder
- T reading on measuring cylinder with stone fully immersed in the water
- U temperature of water

Which three measurements are needed to determine the density of the stone?

- A** P, R and T
  - B** P, T and U
  - C** Q, R and S
  - D** Q, S and U
- 31** Which device uses a non-renewable energy source?

- A** diesel engine
- B** solar cell
- C** water turbine
- D** windmill

- 32** A metal pan containing water is heated on a hot stove. Energy is transferred thermally from the stove to the water.

How is the energy transferred through the pan and then throughout the water?

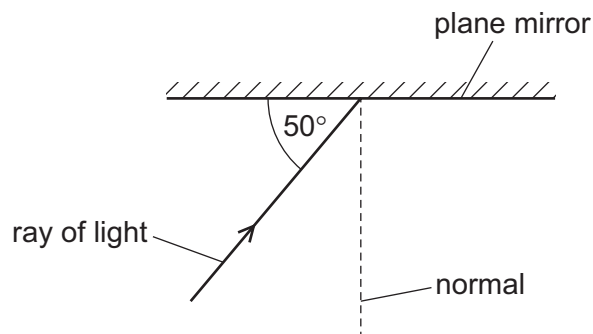
	through the pan	throughout the water
<b>A</b>	conduction	conduction
<b>B</b>	conduction	convection
<b>C</b>	convection	conduction
<b>D</b>	convection	convection

- 33 On a hot, sunny day a boy finds that his head stays cooler when he wears a white hat than when he wears an otherwise identical black hat.

Why does the white hat keep his head cooler?

- A It absorbs less radiation from the Sun than the black hat.
  - B It conducts less heat energy than the black hat.
  - C It conducts more heat energy than the black hat.
  - D It emits more radiation from his head than the black hat.
- 34 Which wave is longitudinal?
- A infrared
  - B radio
  - C sound
  - D ultraviolet

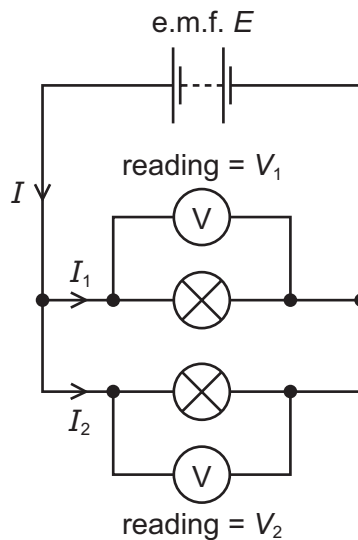
- 35 The diagram shows light striking a plane mirror.



What is the angle of reflection of the ray when it is reflected from the mirror?

- A  $40^\circ$
- B  $50^\circ$
- C  $80^\circ$
- D  $100^\circ$

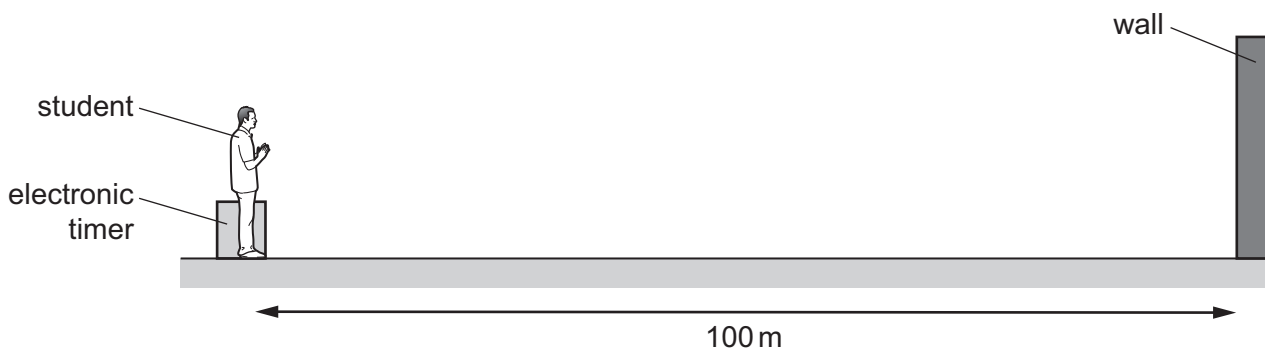
- 36 A circuit contains a battery of e.m.f.  $E$ , two lamps and two voltmeters, connected as shown. The voltmeter readings  $V_1$  and  $V_2$ , and the current in three parts of the circuit  $I$ ,  $I_1$  and  $I_2$  are labelled.



Which row gives expressions for current  $I$  and e.m.f.  $E$ ?

	current $I$	e.m.f. $E$
<b>A</b>	$I = I_1 = I_2$	$E = V_1 = V_2$
<b>B</b>	$I = I_1 = I_2$	$E = V_1 + V_2$
<b>C</b>	$I = I_1 + I_2$	$E = V_1 = V_2$
<b>D</b>	$I = I_1 + I_2$	$E = V_1 + V_2$

- 37 A student measures the speed of sound. He claps his hands and the sound reflects from a wall that is 100 m away from him.



An electronic timer next to the student detects the echo of the sound 0.60 s after it is made.

Which calculation gives the speed of sound?

- A**  $\frac{200}{0.30}$  m/s      **B**  $\frac{200}{0.60}$  m/s      **C**  $\frac{100}{0.60}$  m/s      **D**  $\frac{100}{1.2}$  m/s

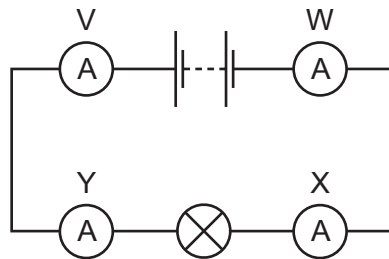
38 A piece of wire has a resistance of  $8.0\ \Omega$ .

The length of the wire is doubled and the diameter of the wire is halved.

What is the new resistance of the wire?

- A**  $2.0\ \Omega$       **B**  $4.0\ \Omega$       **C**  $8.0\ \Omega$       **D**  $64\ \Omega$

39 Four ammeters V, W, X and Y are connected in the circuit shown.



Which ammeters have the same reading as each other?

- A** V and W only  
**B** V and Y only  
**C** X and Y only  
**D** V, W, X and Y

40 A  $20\text{ V}$  power supply provides a current of  $5.0\text{ A}$  for  $1.0$  minute.

How much energy does the power supply deliver?

- A**  $4.0\text{ J}$       **B**  $100\text{ J}$       **C**  $240\text{ J}$       **D**  $6000\text{ J}$

**BLANK PAGE**

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cambridgeinternational.org](http://www.cambridgeinternational.org) after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

## The Periodic Table of Elements

		Group											
I	II	III	IV	V	VI	VII	VIII						
3 Li lithium 7	4 Be beryllium 9	11 Na sodium 23	12 Mg magnesium 24	19 K potassium 39	20 Ca calcium 40	37 Rb rubidium 85	55 Cs caesium 133	87 Fr francium —	1 H hydrogen 1	2 He helium 4			
19 K potassium 39	20 Ca calcium 40	37 Rb rubidium 85	55 Cs caesium 133	87 Fr francium —	1 H hydrogen 1	2 He helium 4	10 Ne neon 20	18 Ar argon 40	36 Kr krypton 84	54 Xe xenon 131			
57 La lanthanum 139	89 Ac actinium —	72 Hf hafnium 178	74 W tungsten 184	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	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 —
58 Ce cerium 140	90 Th thorium 232	80 Zr zirconium 91	82 Hf hafnium 178	84 Yb ytterbium 173	86 Dy dysprosium 163	88 Er erbium 167	90 Yb ytterbium 173	92 U uranium 238	94 Pu plutonium 238	96 Cm curium —	98 Cf californium —	100 Fm fermium —	102 No nobelium —
59 Pr praseodymium 141	91 Pa protactinium 231	81 Nb niobium 93	83 Ta tantalum 181	85 Re rhenium 186	87 Ir iridium 192	89 Au gold 197	91 Tb terbium 159	93 Eu europium 152	95 Gd gadolinium 157	97 Dy dysprosium 163	99 Er erbium 167	101 Tm thulium 169	103 Yb ytterbium 173
60 Nd neodymium 144	92 U uranium 238	82 Mo molybdenum 96	84 Ru ruthenium 101	86 Pd palladium 106	88 Pt platinum 195	90 Zn zinc 65	92 Ce cerium 140	94 Sm samarium 150	96 Gd gadolinium 157	98 Dy dysprosium 163	100 Er erbium 167	102 Tm thulium 169	104 Lu lutetium 175
61 Pm promethium —	93 Np neptunium —	83 Tc technetium —	85 Rh rhodium 103	87 Ag silver 108	89 Au gold 197	91 Cu copper 64	93 Eu europium 152	95 Gd gadolinium 157	97 Dy dysprosium 163	99 Er erbium 167	101 Tm thulium 169	103 Yb ytterbium 173	105 Lu lutetium 175
62 Sm samarium 150	94 Pu plutonium 238	84 Ru ruthenium 101	86 Pd palladium 106	88 Pt platinum 195	90 Zn zinc 65	92 Ce cerium 140	94 Sm samarium 150	96 Gd gadolinium 157	98 Dy dysprosium 163	100 Er erbium 167	102 Tm thulium 169	104 Lu lutetium 175	106 Lu lutetium 175
63 Eu europium 152	95 Am americium —	85 Rh rhodium 103	87 Ag silver 108	89 Au gold 197	91 Cu copper 64	93 Eu europium 152	95 Gd gadolinium 157	97 Dy dysprosium 163	99 Er erbium 167	101 Tm thulium 169	103 Yb ytterbium 173	105 Lu lutetium 175	107 Lu lutetium 175
64 Gd gadolinium 157	96 Cm curium —	86 Pd palladium 106	88 Pt platinum 195	90 Zn zinc 65	92 Ce cerium 140	94 Sm samarium 150	96 Gd gadolinium 157	98 Dy dysprosium 163	100 Er erbium 167	102 Tm thulium 169	104 Lu lutetium 175	106 Lu lutetium 175	108 Lu lutetium 175
65 Tb terbium 159	97 Bk berkelium —	87 Ag silver 108	89 Au gold 197	91 Cu copper 64	93 Eu europium 152	95 Gd gadolinium 157	97 Dy dysprosium 163	99 Er erbium 167	101 Tm thulium 169	103 Yb ytterbium 173	105 Lu lutetium 175	107 Lu lutetium 175	109 Lu lutetium 175
66 Dy dysprosium 163	98 Cf californium —	88 Pt platinum 195	90 Zn zinc 65	92 Ce cerium 140	94 Sm samarium 150	96 Gd gadolinium 157	98 Dy dysprosium 163	100 Er erbium 167	102 Tm thulium 169	104 Lu lutetium 175	106 Lu lutetium 175	108 Lu lutetium 175	110 Lu lutetium 175
67 Ho holmium 165	99 Es einsteinium —	89 Au gold 197	91 Cu copper 64	93 Eu europium 152	95 Gd gadolinium 157	97 Dy dysprosium 163	99 Er erbium 167	101 Tm thulium 169	103 Yb ytterbium 173	105 Lu lutetium 175	107 Lu lutetium 175	109 Lu lutetium 175	111 Lu lutetium 175
68 Er erbium 167	100 Fm fermium —	90 Zn zinc 65	92 Ce cerium 140	94 Sm samarium 150	96 Gd gadolinium 157	98 Dy dysprosium 163	100 Er erbium 167	102 Tm thulium 169	104 Lu lutetium 175	106 Lu lutetium 175	108 Lu lutetium 175	110 Lu lutetium 175	112 Lu lutetium 175
69 Tm thulium 169	101 Md mendelevium —	91 Cu copper 64	93 Eu europium 152	95 Gd gadolinium 157	97 Dy dysprosium 163	99 Er erbium 167	101 Tm thulium 169	103 Yb ytterbium 173	105 Lu lutetium 175	107 Lu lutetium 175	109 Lu lutetium 175	111 Lu lutetium 175	113 Lu lutetium 175
70 Yb ytterbium 173	102 No nobelium —	92 Ce cerium 140	94 Sm samarium 150	96 Gd gadolinium 157	98 Dy dysprosium 163	100 Er erbium 167	102 Tm thulium 169	104 Lu lutetium 175	106 Lu lutetium 175	108 Lu lutetium 175	110 Lu lutetium 175	112 Lu lutetium 175	114 Lu lutetium 175
71 Lu lutetium 175	103 Lr lawrencium —	93 Eu europium 152	95 Gd gadolinium 157	97 Dy dysprosium 163	99 Er erbium 167	101 Tm thulium 169	103 Yb ytterbium 173	105 Lu lutetium 175	107 Lu lutetium 175	109 Lu lutetium 175	111 Lu lutetium 175	113 Lu lutetium 175	115 Lu lutetium 175

## Key

atomic number  
atomic symbol  
name  
relative atomic mass

lanthanoids

actinoids

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).