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Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6484841733

COMBINED SCIENCE **0653/32**

Paper 3 Theory (Core) **February/March 2023**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].
- The Periodic Table is printed in the question paper.

This document has **20** pages. Any blank pages are indicated.

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[Turn over

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1 **(a)** The alimentary canal of a human and a bear are similar.

Fig. 1.1 shows the alimentary canal and associated organs of a bear.

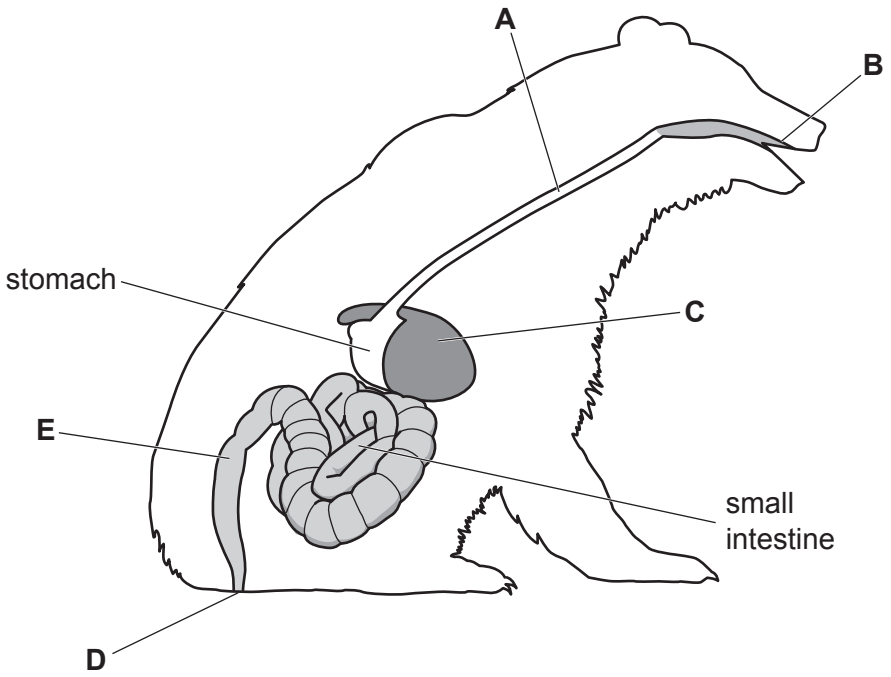


Fig. 1.1

(i) Table 1.1 shows the names and functions of some of the parts labelled **A**–**E** in Fig. 1.1.

Complete Table 1.1 by writing your answers in the boxes.

Table 1.1

name of part	letter in Fig. 1.1	function
	B	ingestion
oesophagus		moves food to the stomach
anus		

[4]

(ii) Digestion takes place in the stomach.

Complete this sentence about digestion.

Digestion breaks down large food molecules using chemical and ..... processes. [1]

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(b) Chemical digestion uses enzymes to break down large food molecules.

Fig. 1.2 shows the effect of temperature on the activity of two different enzymes, **J** and **K**.

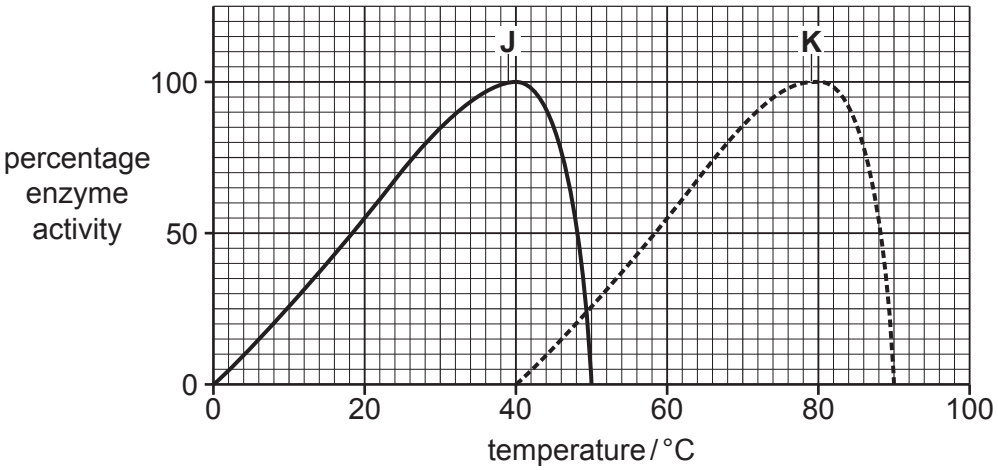


Fig. 1.2

(i) Identify the temperature in Fig. 1.2 when **both** enzymes have the same percentage activity value.

temperature = ... °C. [1]

(ii) Describe the effect of temperature on the activity of enzyme **K** in Fig. 1.2.

Use data in your answer.

.....

.....

..... [2]

(c) All enzymes are made from one type of molecule.

(Circle) this type of molecule.

fat **fibre** **protein** **vitamin** [1]

[Total: 9]

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2 A student adds excess magnesium to dilute sulfuric acid.

The equation for the reaction is shown.

$$Mg(s) + H_2SO_4(aq) \longrightarrow MgSO_4(aq) + H_2(g)$$

(a) (i) State whether the change shown in the equation is a chemical change or a physical change.

Explain your answer.

change .....

explanation .....

.....

[1]

(ii) Use the equation to identify the solvent and **one** solute.

solvent .....

solute .....

[2]

(iii) Describe the test for hydrogen gas and state the observation for a positive result.

test .....

.....

observation .....

[1]

(iv) State the separation process that is used to remove unreacted magnesium from the reaction mixture.

..... [1]

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(b) (i) Magnesium atoms can have different numbers of neutrons.

One atom of magnesium is represented as shown.

$$^{26}_{12}Mg$$

Use this information to complete Table 2.1 to show the number of protons, neutrons and electrons in this atom.

Table 2.1

number of protons	number of neutrons	number of electrons

[3]

(ii) State how a magnesium atom differs from a magnesium ion, Mg^{2+}.

.....

..... [1]

[Total: 9]

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3 Fig. 3.1 shows a distance–time graph for a student riding a bicycle.

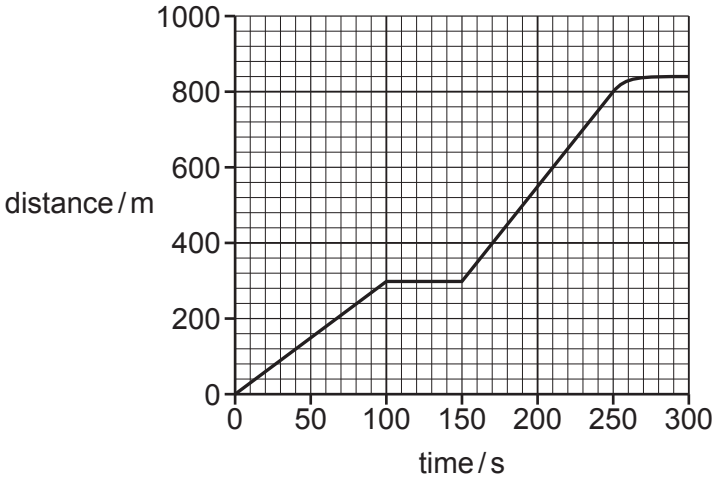


Fig. 3.1

(a) (i) On Fig. 3.1, mark with an **X** where the student is travelling fastest. [1]

(ii) On Fig. 3.1, mark with a **Y** where the student is gradually slowing down. [1]

(b) (i) During the journey, the student rests for some time before moving on again.

Use Fig. 3.1 to determine for how long the student rests.

time = ... s [1]

(ii) The student's journey takes 300 s.

Use Fig. 3.1 to calculate the average speed for the journey.

speed = ... m / s [2]

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(c) (i) Fig. 3.2 shows the student holding the bicycle off the ground with an upwards force of 97 N.

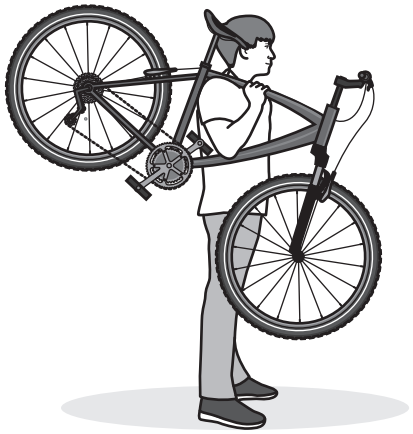


Fig. 3.2

The gravitational force on unit mass is 10 N / kg.

Calculate the mass of the bicycle.

mass = ... kg [2]

(ii) The student does useful work to lift the bicycle off the ground.

Use words and phrases from the list below to state the **useful** energy transfers that take place.

Each word or phrase may be used once, more than once, or not at all.

chemical potential **elastic potential** **electrical potential**

gravitational potential **kinetic** **sound** **thermal**

Energy is transferred:

from ..... energy in the student

to ..... energy of the moving bicycle

and then to ..... energy in the stationary lifted bicycle. [3]

(iii) Explain why the total energy transferred by the student is more than the useful work done on the bicycle.

.....

.....

..... [1]

[Total: 11]

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4 **(a)** The boxes on the left name some parts of the male reproductive system in humans.

The boxes on the right state the functions of some of these parts.

Draw **one** straight line from each part to its function.

part	function
	carries urine and semen out of the body
prostate gland	
	sac that holds testes outside the body
scrotum	
	secretes fluid for sperm to swim in

[2]

(b) Fertilisation takes place in the female reproductive system in humans.

(i) The fertilised ovum divides to form a ball of cells.

State the name of this ball of cells.

..... [1]

(ii) The ball of cells develops into a fetus inside the uterus.

State the name of the ring of muscle at the opening of the uterus.

..... [1]

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(c) A scientist measures the growth of a human fetus.

Table 4.1 shows the measurements.

Table 4.1

age of fetus /weeks	length of fetus /mm	mass of fetus /g
8	15	1
16	116	100
24	300	600
32	424	1702
40	512	3404

(i) Use Table 4.1 to calculate the increase in length of the fetus between **week 16** and **week 24**.

length = ... mm [1]

(ii) Identify when the **mass** of the fetus doubles.

Place one tick (✓) in the correct box.

week 8 to week 16	
week 16 to week 24	
week 24 to week 32	
week 32 to week 40	

[1]

(iii) Define the term growth.

.....

..... [1]

(d) The developing fetus absorbs oxygen from the mother's blood for aerobic respiration.

Complete the word equation for aerobic respiration.

..... + oxygen → ..... + ...

[2]

[Total: 9]

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[Turn over

5 Copper is a transition element.

(a) State **two** properties of transition elements that are **not** properties of Group I metals.

1 .....

2 .....
[2]

(b) Copper is extracted from copper oxide by heating with carbon.

Identify the greenhouse gas formed in this process.

..... [1]

(c) Copper is slowly oxidised by oxygen when it is left in air.

The reaction equation is shown.

$$2Cu(s) + O_2(g) \rightarrow 2CuO(s)$$

(i) State the meaning of the term oxidised.

.....

..... [1]

(ii) Suggest **one** change that increases the rate of this reaction.

..... [1]

(d) **(i)** State the percentage of oxygen in clean air.

..... % [1]

(ii) Suggest the percentage of argon in clean air.

..... % [1]

(iii) State why argon does **not** react with copper.

.....

..... [1]

[Total: 8]

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6 Fig. 6.1 shows a house in the Himalayas. The roof of the house is covered in snow.

As the Sun shines on the roof, the snow begins to melt. Drops of water fall from the roof.

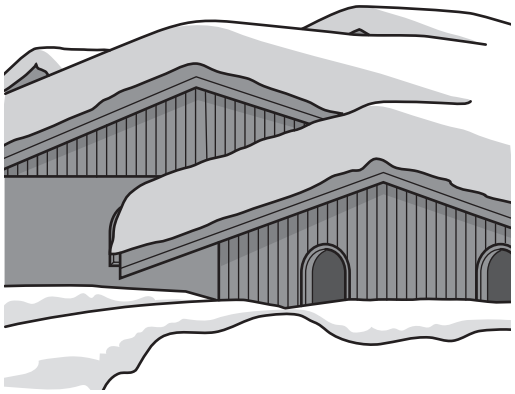


Fig. 6.1

(a) State the temperature at which the snow melts.

temperature = ... °C [1]

(b) Electromagnetic radiation from the Sun transfers thermal energy which warms the snow.

Fig. 6.2 shows part of the electromagnetic spectrum.

← increasing						
gamma radiation	X-rays				microwaves	radio waves

Fig. 6.2

(i) Complete Fig. 6.2 to state the property of electromagnetic radiation that increases in the direction of the arrow. [1]

(ii) Write in the correct space in Fig. 6.2 the name of the type of radiation that transfers thermal energy and warms the snow. [1]

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(c) There is ice on a lake near the house.

Fig. 6.3 shows a ray of light from the Sun incident on the ice.

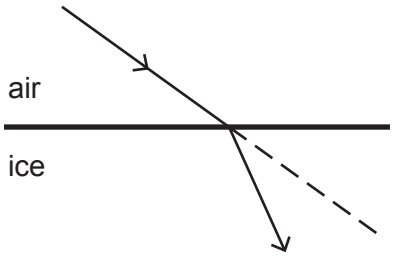


Fig. 6.3

State the term used to describe the change in direction of light as it enters the ice.

..... [1]

(d) Fig. 6.4 shows waves on the surface of the lake when there is no ice on it.



Fig. 6.4

(i) On Fig. 6.4, use a double-headed arrow (↔ or ↕) to show one wavelength. [1]

(ii) A student counts 40 waves moving past her in 25 s.

Calculate the frequency of the waves. Include the unit.

frequency = ... unit = ... [3]

[Total: 8]

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[Turn over

7 **(a)** Fig. 7.1 is a diagram of two guard cells surrounding an open stoma from a plant leaf.

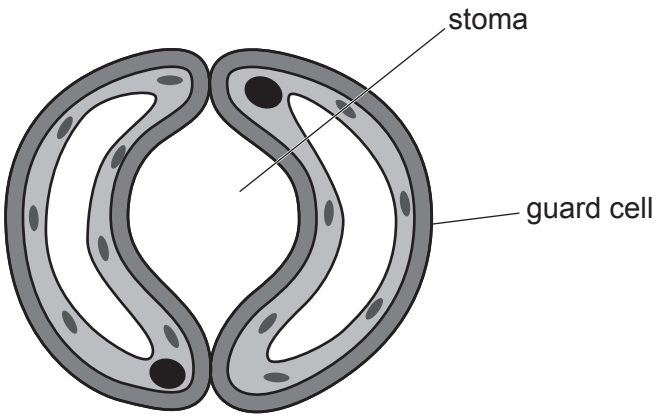


Fig. 7.1

(i) Draw a label line and the letter **C** to identify **one** chloroplast in Fig. 7.1. [1]

(ii) Complete these sentences about guard cells and photosynthesis.

Choose words from the list.

Each word or phrase may be used once, more than once or not at all.

carbon dioxide **epidermis** **evaporation**

mesophyll **nitrogen** **osmosis**

oxygen **palisade** **transpiration**

Guard cells are found in the lower ..... of the leaf.

The stomata are pores that allow the gas needed for photosynthesis to enter.

This gas is called ..... .

Water vapour diffuses out of the stomata during the process of ..... .

[3]

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(b) Fig. 7.2 shows a food chain from a forest.

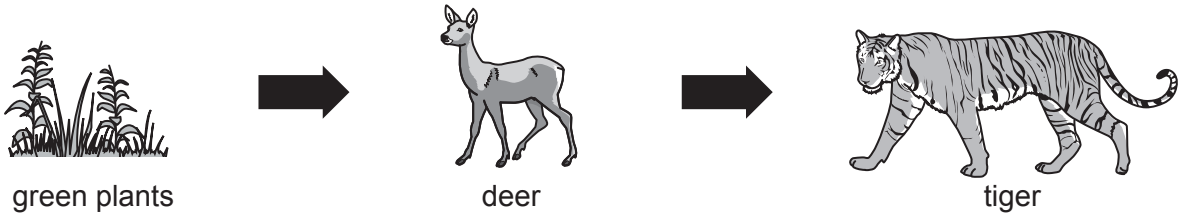


Fig. 7.2

(i) Place ticks (✓) in **all** the boxes that describe the tiger.

carnivore	
herbivore	
primary consumer	
secondary consumer	
tertiary consumer	

[2]

(ii) State the name of the type of organism that gets its energy from waste organic matter.

..... [1]

(c) Deforestation has undesirable effects on the animals in a food chain.

Suggest **two** undesirable effects on the **animals**.

1 .....

2 .....

[2]

[Total: 9]

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[Turn over

8 Methane, CH_4, and ethene, C_2H_4, are hydrocarbons.

(a) Methane is the main constituent of one fossil fuel.

(i) State the name of this fossil fuel.

..... [1]

(ii) State the type of chemical bonding in methane.

..... [1]

(iii) Complete Fig. 8.1 to show the dot-and-cross diagram of a molecule of methane.

Show only the outer shell electrons.

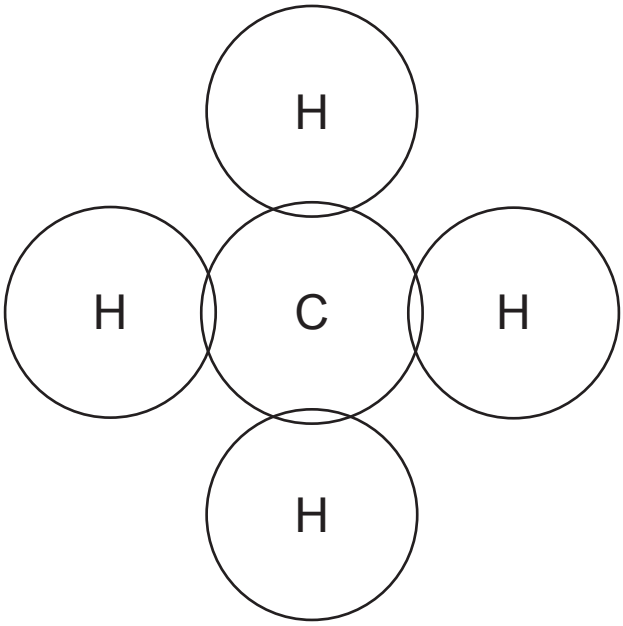


Fig. 8.1

[1]

(iv) State the **two** products of the complete combustion of methane.

1 .....

2 .....

[2]

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(b) Ethene is an unsaturated hydrocarbon.

(i) State what is meant by the terms unsaturated and hydrocarbon.

unsaturated .....

.....

hydrocarbon .....

.....

[2]

(ii) State the process that produces ethene and other unsaturated hydrocarbon molecules from alkanes.

..... [1]

(c) Hydrocarbon **W** turns aqueous bromine colourless.

State whether hydrocarbon **W** is saturated or unsaturated.

Give a reason for your answer.

hydrocarbon **W** .....

reason .....

.....

[1]

[Total: 9]

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9 Fig. 9.1 shows an electrical circuit.

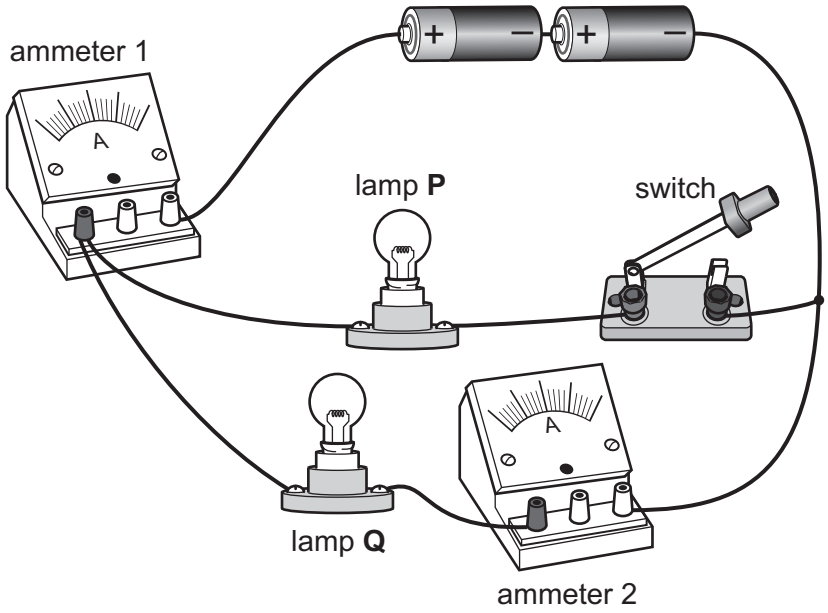


Fig. 9.1

The two lamps **P** and **Q** are identical. When the switch shown in Fig. 9.1 is closed, both lamps **P** and **Q** are equally bright.

(a) State the type of circuit arrangement of the two lamps in this circuit.

..... [1]

(b) When the switch shown in Fig. 9.1 is open, lamp **P** does **not** light up.

State whether lamp **Q** lights up or not. .....

Ammeter 1 shows a current of 0.6A.

State the reading on ammeter 2. ..... A
[1]

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(c) A variable resistor is used to control the current in a circuit.

On Fig. 9.1, mark with an **R** a point where the variable resistor is included in the circuit to control the current through both lamps **P** and **Q**. [1]

(d) The resistance of a different lamp is 8.0 Ω.

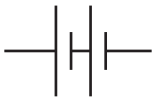
A voltage of 3.0 V is applied across the lamp.

Calculate the current in this lamp.

current = ...A [2]

(e) Fig. 9.2 shows part of the circuit diagram for the circuit shown in Fig. 9.1.

On Fig. 9.2, use standard symbols to complete the circuit diagram.





lamp **Q**

Fig. 9.2

[3]

[Total: 8]

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The Periodic Table of Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 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 –		114 Fl flerovium –		116 Lv livermorium –		

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.).

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