Cambridge
IGCSE

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMBINED SCIENCE 0653/31

Paper 3 (Core) **October/November 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
A copy of the Periodic Table is printed on page 20.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

CAMBRIDGE
International Examinations

[Turn over

1 **(a)** The list shows some processes that occur in living organisms.

breathing **digestion** **excretion** **growth** **movement**

reproduction **sensitivity**

State **two** processes shown in the list which are **not** characteristics of all living things.

1. ....

2. ....

[2]

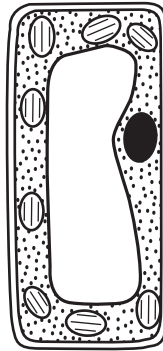**(b)** Fig. 1.1 shows a palisade cell which is found in the leaf of a plant.

Fig. 1.1

(i) On Fig. 1.1 use a label line and the correct name to show **one** structure that is present in **all** plant cells but is absent from animal cells. [2]

(ii) Describe the pathway taken by water in the plant, from the soil to the palisade cells.

....

....

....

....[3]

(c) Fig. 1.2 shows a plant growing in front of a large rock.

Fig. 1.2

(i) The leaves of the plant in Fig. 1.2 turn towards the light.

Name the plant's response to light.

....[1]

(ii) The leaves of the plant in Fig. 1.2 are separated from each other as much as possible and do not overlap.

Suggest **and** explain why this is an advantage for the plant.

....

....

....[2]

2 **(a)** Complete the following sentences using words from the list.

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

atoms	compounds	covalent	elements
ionic	ions	mixtures	molecules

(i) The smallest parts of an element are ....   [1]

(ii) All .... contain atoms joined by sharing pairs of electrons

in .... bonds.   [2]

(iii) Atoms which lose or gain electrons form particles called

....   [1]

(iv) Elements in .... cannot be separated by simple physical

processes.

Substances in .... can be separated by simple physical

processes.   [2]

(b) A student passes an electric current through aqueous copper chloride using the apparatus shown in Fig. 2.1.
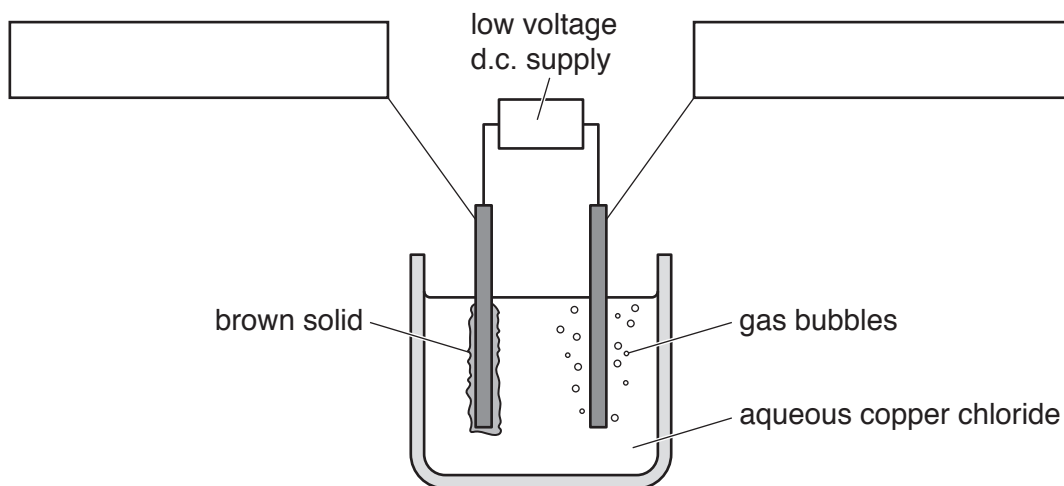
Fig. 2.1

(i) Complete the labels in Fig. 2.1 by naming the two electrodes.   [2]

(ii) Name the solid and the gas formed in this process.

solid ....

gas ....   [2]

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3 Fig. 3.1 shows a train made up of a steam engine and a passenger coach.

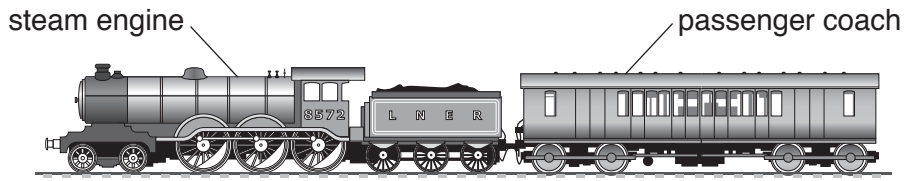steam engine   passenger coach

Fig. 3.1

(a) The train is travelling at a constant speed along a level track. Fig. 3.2 shows the four forces **W**, **X**, **Y** and **Z** acting on the train.
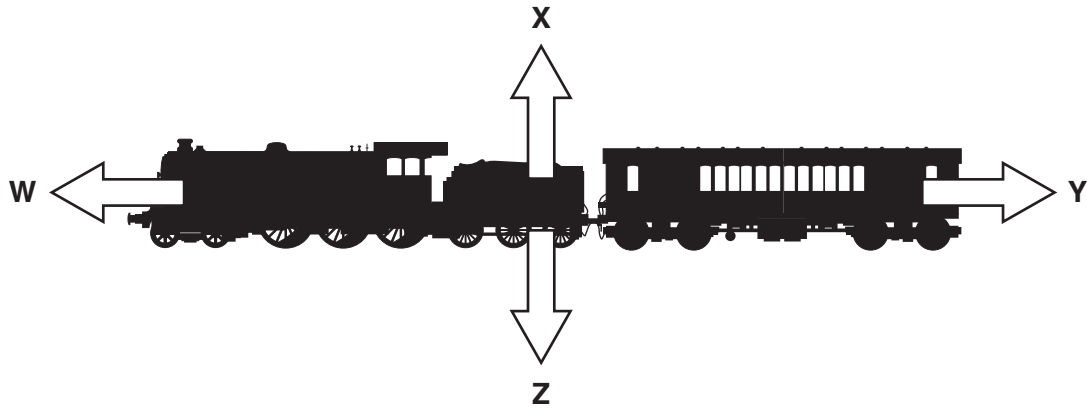

Fig. 3.2

(i) Name force **Z**.

....[1]
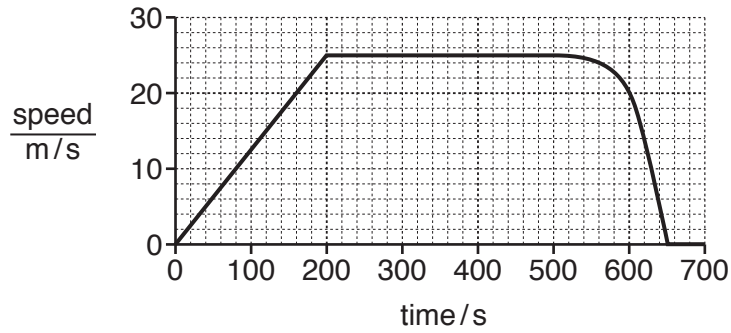
(ii) The force arrows on Fig. 3.2 do not show the sizes of the forces.

State whether or not the driver has made force **W** equal in size to force **Y**.

Explain your answer.

....

....[1]

(b) Fig. 3.3 shows a speed–time graph of the train as it travels between two stations.

Fig. 3.3

(i) On Fig. 3.3, use the letter **P** to label **one** point in the journey when the train is travelling with changing speed. [1]

(ii) The distance between the two stations is 12.8 km.

State the distance between the stations in metres.

distance = ... m [1]

(iii) Use your answer to **(b)(ii)** and information from the graph to calculate the average speed of the train on this journey in m/s.

Show your working.

average speed = ... m/s [2]

(c) The steam engine is powered by burning coal to boil water. This makes steam that moves the engine.

Complete the energy transfer that moves the train.

.... energy in the coal

⟶ .... energy of the train. [2]

(d) State the **original** source of the energy stored in coal.

....[1]

 [Turn over

4 Fig. 4.1 shows part of an aquatic food web.
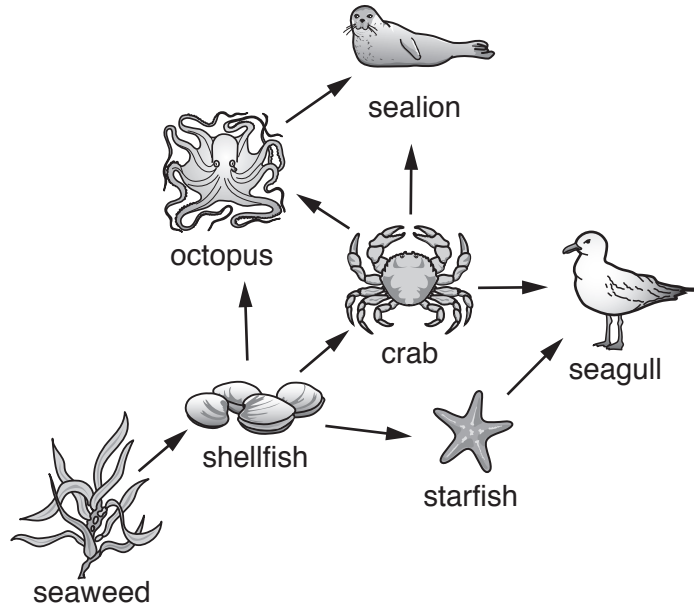
Fig. 4.1

(a) From Fig. 4.1 state the name of

a producer,

....

a herbivore,

....

a consumer.

....
[3]

(b) The food web in Fig. 4.1 is made from interconnected food chains.

Write **two** complete food chains which contain the crab.

1. ....

2. ....
[3]

(c) The population of crabs reduces suddenly.

Suggest **two** reasons why this causes the octopus population to decrease.

1. ....

....

2. ....

....

[2]

5 **(a)** A student makes magnesium sulfate by reacting magnesium with a dilute acid.

   (i) Name the acid.

   ....[1]

   (ii) Describe the pH change of the mixture during the reaction.

   ....[1]

   (iii) Name **one other** substance that reacts with this acid to make magnesium sulfate.

   ....[1]

   (iv) The reaction between magnesium and this acid is exothermic.

   State what is meant by the term *exothermic*.

   ....

   ....[1]

(b) Another student reacts calcium with excess dilute acid in a beaker.

Calcium sulfate forms as a solid in the beaker.

Suggest the separation method that is used to separate the solid calcium sulfate from the excess acid.

Explain how this separation method removes the solid from the liquid.

method ....

explanation ....

....

....
[2]

(c) Calcium is in Group II of the Periodic Table.

(i) Complete the following sentences using words from the list.

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

good   high   low   poor

Calcium is a .... electrical conductor.

Calcium has a .... melting point.
[1]

(ii) State the order of reactivity of calcium, magnesium and sodium.

.... most reactive

....

.... least reactive
[1]

6 Fig. 6.1 shows a liquid-in-glass thermometer at room temperature.
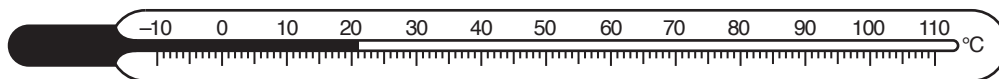
Fig. 6.1

(a) State the property of a liquid that is used in a thermometer when measuring temperature.

....[1]

(b) Table 6.1 gives a list of the melting point and boiling point of five substances that are used in liquid-in-glass thermometers.

Table 6.1

substance	melting point /°C	boiling point /°C
ethanol	−114	78
gallium	30	2403
glycol	−12	198
mercury	−39	357
water	0	100

(i) Ammonia has a melting point of −78 °C and a boiling point of −33 °C.

State which substance could be used in a liquid-in-glass thermometer to measure both the melting point and boiling point of ammonia. Explain your answer.

substance ....

explanation ....

....
[2]

(ii) Explain why a thermometer that uses liquid gallium has to be kept in a warm container, well above room temperature.

....

....

....[2]

(c) An infra-red thermometer measures temperature in a different way. The wavelength of the infra-red radiation emitted by a hot body changes with temperature.

An infra-red thermometer measures the wavelengths of the infra-red radiation emitted and converts these to temperature readings.

(i) Fig. 6.2 shows a wave motion with the waves moving from left to right.
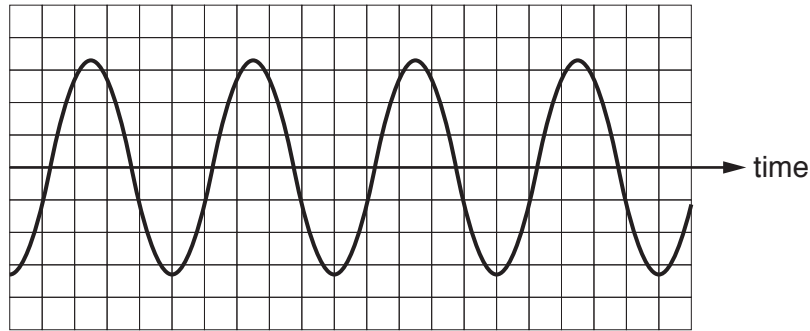
Fig. 6.2

State the number of complete wavelengths shown in Fig. 6.2.

....[1]

(ii) The wavelength of the infra-red radiation emitted decreases as the temperature of the hot body increases.

Predict what happens to the frequency of the infra-red radiation as the temperature of the hot body increases.

Explain your answer.

prediction ....

explanation ....

....
[2]

(iii) In the infra-red thermometer, the radiation is focused onto the detector by a thin converging lens.

On Fig. 6.3 complete the ray diagram to show how this happens.
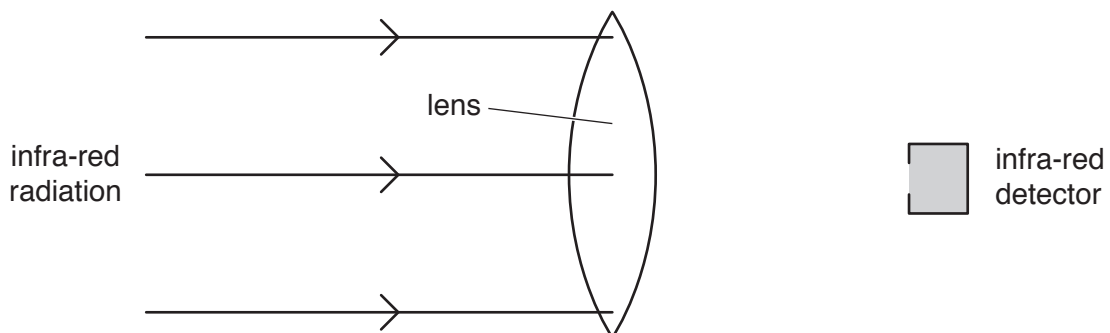
Fig. 6.3 [1]

7 (a) Table 7.1 shows some features of arteries, veins and capillaries.

Place a tick (✓) in the correct boxes in Table 7.1 to show the features of each blood vessel.

Table 7.1

feature	blood vessel		
	artery	vein	capillary
carries blood away from the heart			
contains valves			
walls are one cell thick			
exchange of materials occurs here			

[3]

(b) A boy starts to play football. Immediately the concentration of the hormone adrenaline in his blood increases.

(i) Describe **two** effects of adrenaline in the boy's body.

1. ....

2. ....

[2]

(ii) The concentration of adrenaline in the boy's blood decreases after playing football.

Describe how the adrenaline is removed from his blood.

....

....[1]

(c) The boy is 10 years old. It is important that he includes enough calcium and iron in his diet.

(i) State **one** food which is a good source of calcium.

....[1]

(ii) Describe why calcium is important in the body.

....[1]

(iii) Describe the symptoms the boy may have if he does not have enough iron in his diet.

....

....[1]

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8 Petroleum is separated into more useful substances using the process shown in Fig. 8.1.

→ refinery gas

→ gasoline

→ gas oil

petroleum →
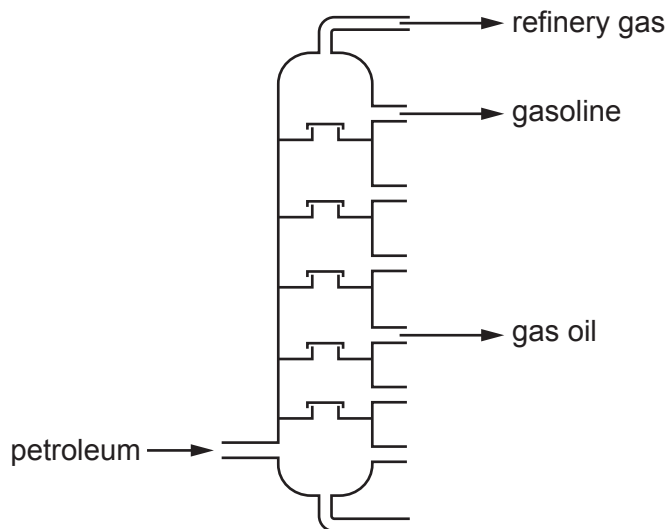
Fig. 8.1

(a) (i) Name this process.

....[1]

(ii) State **one** use for gas oil.

....[1]

(b) During the complete combustion of gasoline, the amounts of some gases in the air change.

Name **two** of these gases and describe the change in the amount of each.

gas 1

name ....

change ....

gas 2

name ....

change ....

[4]

(c) The formula of ethanol is C_2H_5OH.

Complete the structure of a molecule of ethanol.

Show all of the bonds between the atoms.

C—C

[2]

9   Fig. 9.1 shows a dishwasher (an electric dishwashing machine).
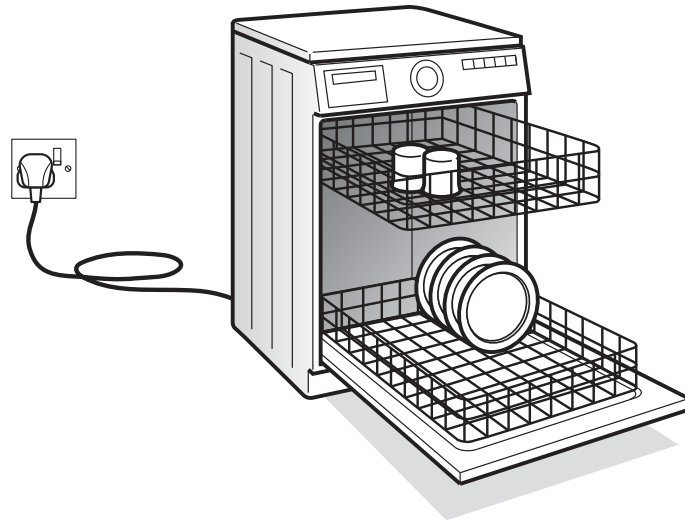
Fig. 9.1

The dishwasher uses electrical energy to power

•   a heater to heat the water used,

•   a motor to pump the hot water through the machine.

The circuit symbols for a heater and a motor are:
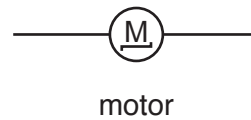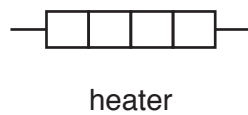
heater   motor

Fig. 9.2 shows part of the circuit diagram for the dishwasher.

240 V
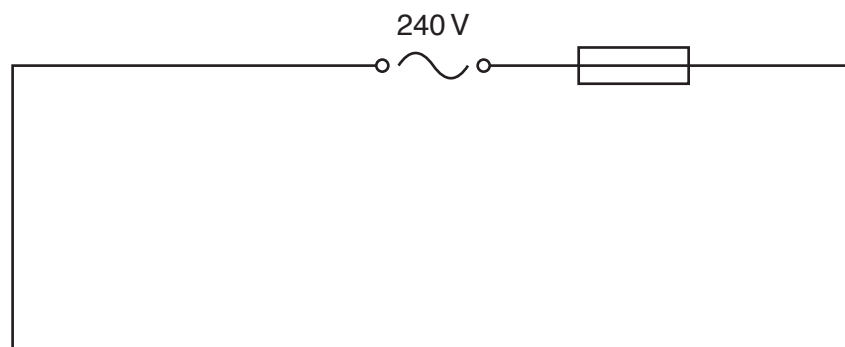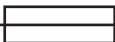
Fig. 9.2

(a) (i) The heater and the motor are connected in parallel.

A switch turns both the heater and the motor on and off.

On Fig. 9.2 complete the circuit diagram for the dishwasher. [3]

(ii) Name the component in Fig. 9.2 represented by the symbol ⎯⎯⎯|▭|⎯⎯⎯ and state the reason for including it in the circuit.

component ....

reason ....

....
[2]

(b) When switched on, the resistance of the heater is $24\,\Omega$ and the resistance of the motor is $4\,\Omega$.

(i) Use the formula $R = \dfrac{V}{I}$ to calculate the current through the heater.

Show your working and give the unit of your answer.

working

current = ... unit .... [3]

(ii) Put a circle around the likely value of the combined resistance of the heater and motor in this circuit. Give a reason for your choice.

$3.4\,\Omega$ $28\,\Omega$

reason ....

....[1]

The Periodic Table of Elements

Group

Key

atomic number
atomic symbol
name
relative atomic mass

I	II		III	IV	V	VI	VII	VIII
								2 He helium 4
1 H hydrogen 1								
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 –		

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.).