

CANDIDATE  
NAME

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CENTRE  
NUMBER

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**COMBINED SCIENCE**

**0653/32**

Paper 3 (Core)

**February/March 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.

This document consists of **18** printed pages and **2** blank pages.

- 1 (a) Fig. 1.1 shows a diagram of the female reproductive system and some of the events that take place before and during early pregnancy.

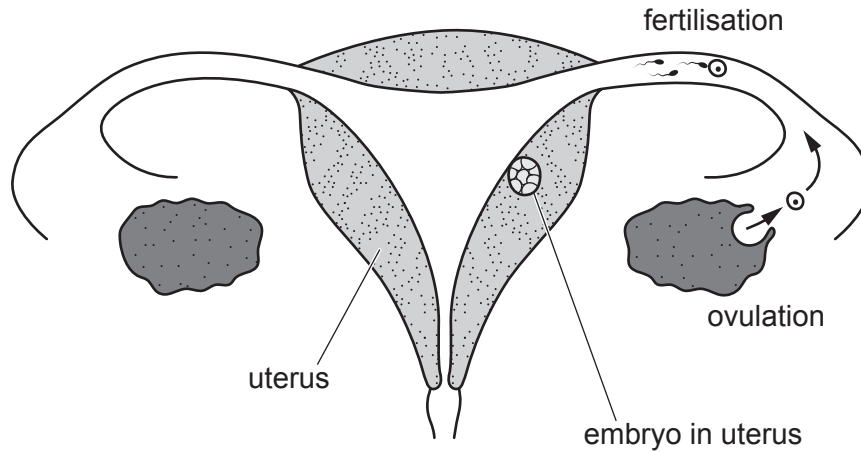


Fig. 1.1

- (i) On Fig. 1.1 use label lines to identify
1. the cervix,
  2. the vagina. [2]

- (ii) Describe the events that follow fertilisation leading to the presence of the embryo in the uterus as shown in Fig. 1.1.

.....

.....

.....

.....[3]

- (b) Use words or phrases from the list to complete the following sentences about reproduction in a plant.

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

- a chromosome      a quarter of      a seed      diploid      half**  
**haploid      the same      twice**

Pollen grains have ..... nuclei because they contain  
 ..... the amount of genetic information as the nuclei  
 of palisade cells. The nucleus of a fertilised egg cell is .....

[3]

2 (a) Copper is extracted from a substance using the apparatus shown in Fig. 2.1.

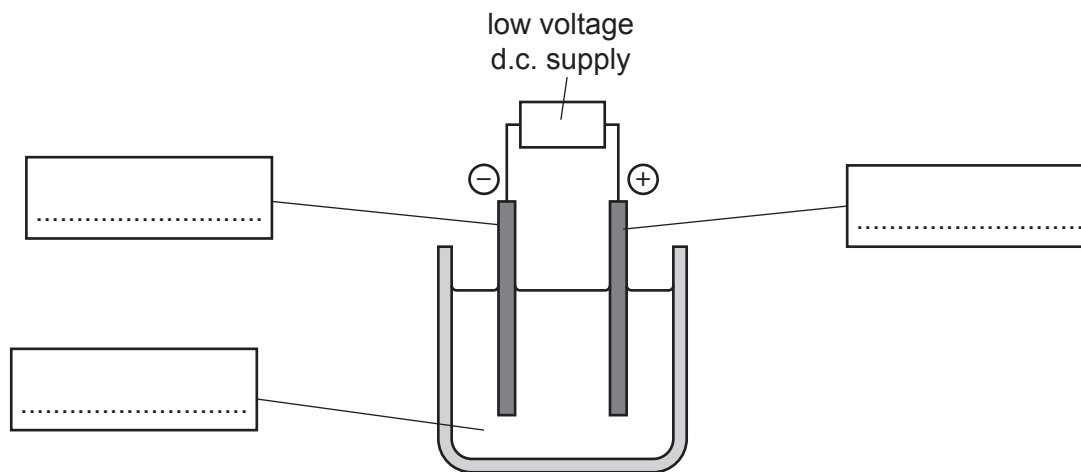


Fig. 2.1

(i) Name this process.

.....[1]

(ii) Complete Fig. 2.1 by labelling the *anode*, *cathode* and *electrolyte*. [2]

(iii) Name **one** compound that can be used in this process to extract copper at room temperature.

.....[1]

(iv) State what is done to this solid compound before it can be used in this process.

.....[1]

(v) State whether this process for the extraction of copper involves a *chemical change* or a *physical change*.

Explain your answer.

change .....

explanation .....

..... [1]

(b) A student finds out that copper can also be extracted by heating a different compound, copper oxide, with a non-metallic element.

(i) Name this non-metallic element.

.....[1]

(ii) Name the type of chemical reaction in which copper oxide is changed to copper.

.....[1]

(c) Copper is one element in a collection of metals which have high melting points, high densities and often act as catalysts.

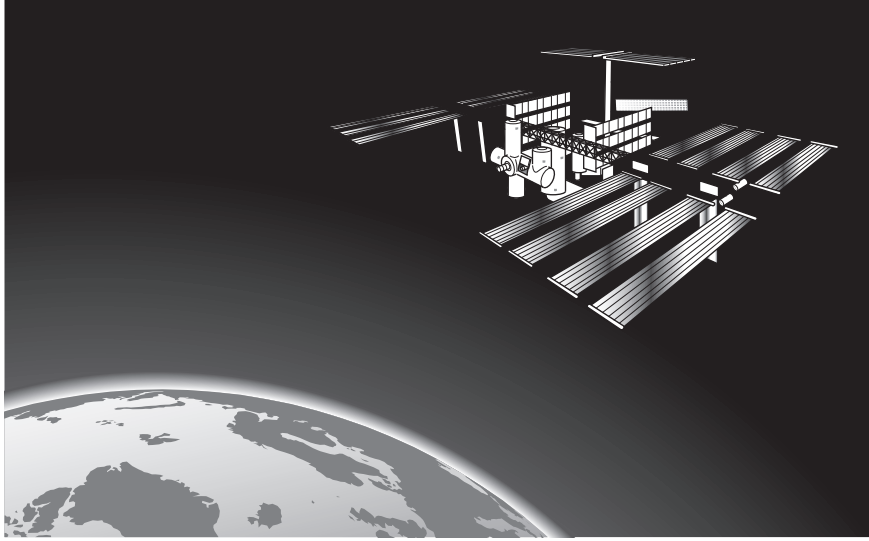
(i) Suggest one other property that is shown by these metals that is not shown by other metals.

.....[1]

(ii) State the effect of a catalyst on a chemical reaction.

.....[1]

- 3 Fig. 3.1 is a diagram which shows the International Space Station which is kept in orbit around the Earth by a force which prevents it escaping into space.



**Fig. 3.1**

- (a) Name this force.

.....[1]

- (b) On one of its orbits, the space station travels at a speed of 28 000 km/h and takes 90 minutes to complete one orbit of the Earth.

Calculate the distance travelled by the space station during this orbit.

Show your working.

distance = ..... km [2]

(c) The mass of the Earth is  $5972 \times 10^{21}$  kg.

The volume of the Earth is  $1.08 \times 10^{21}$  m<sup>3</sup>.

Calculate the density of the Earth.

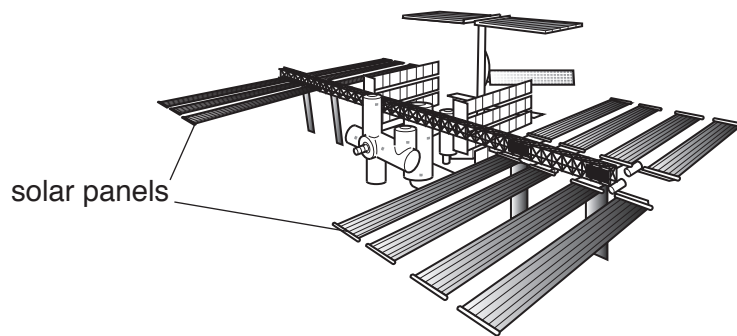
State the formula you use, show your working and give the units of your answer.

formula

working

density = ..... units ..... [3]

(d) Fig. 3.2 shows the large solar panels that provide energy for the space station.



**Fig. 3.2**

(i) The solar cells are in large panels that face the Sun to gather energy. This energy is stored by charging batteries on board the space station.

Complete the sequence of energy conversions that take place.

Radiation from the Sun

to ..... energy in the solar cells

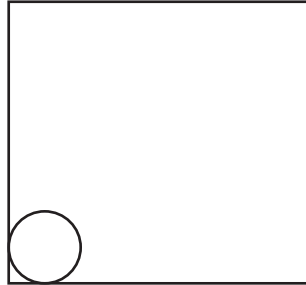
to ..... energy in the batteries.

[2]

- (ii) Each solar cell contains solid crystals of silicon.

On Fig. 3.3 below draw a diagram to show the arrangement of atoms in a crystal of silicon.

One atom has been drawn for you; you should draw at least 10 more atoms of the same size.



**Fig. 3.3**

[2]

- 4 Fig. 4.1 shows a giant panda which lives in bamboo forests in China.



Fig. 4.1

- (a) The panda has the diet of a herbivore. It feeds almost entirely on bamboo shoots.

Define the term *herbivore*.

.....  
 .....[1]

- (b) Table 4.1 shows the mass of protein contained in 100g of bamboo shoots and 100g of beef.

Table 4.1

nutrient	bamboo shoots/g	beef/g
protein	2.6	20.0

- (i) State the roles of protein in the body.

.....  
 .....[2]

- (ii) Calculate the mass of bamboo shoots needed to provide the same amount of protein as 100g of beef.

mass = ..... g [2]

- (iii) Use your answer from (ii) to suggest why the panda has to eat large amounts of shoots every day.

.....  
 .....  
 .....[2]



(c) Deforestation is causing the population of pandas in the area to decrease.

Suggest **two** reasons why deforestation decreases the population of pandas in bamboo forests.

1. ....

.....

2. ....

.....

[2]

5 Petroleum is a mixture of hydrocarbons. It is separated into useful fractions by the process of fractional distillation.

This process is shown in Fig. 5.1.

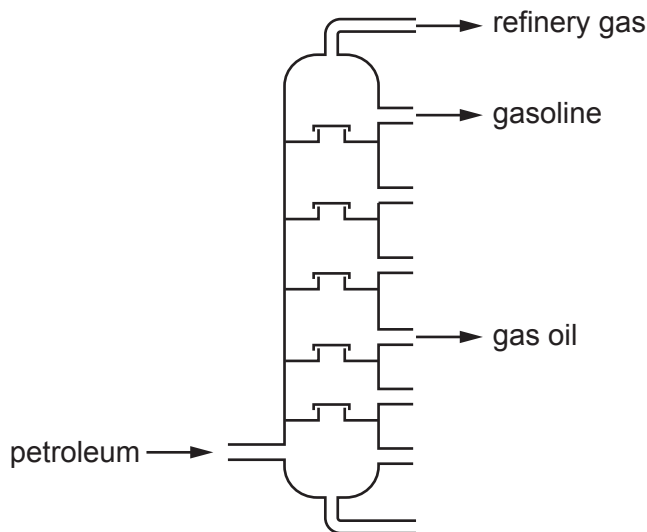


Fig. 5.1

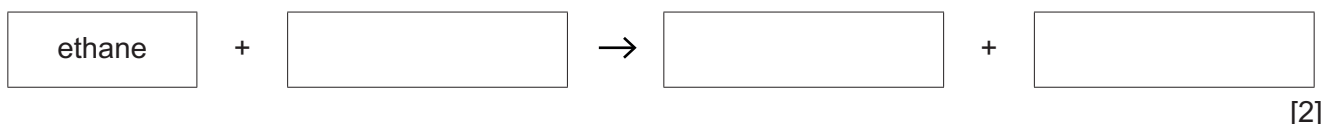
(a) (i) State what is meant by the term *hydrocarbon*.

.....  
 .....[2]

(ii) Ethane is found in refinery gas.

Methane and ethane are both hydrocarbons and form the same products when they burn.

Complete the word equation for the complete combustion of ethane.



(iii) During the combustion of ethane there is a temperature rise.

State the type of chemical reaction that produces a temperature rise.

.....[1]

(iv) State **one** use for bottled refinery gas.

.....[1]

(b) Oil and grease are produced from petroleum.

Describe how these substances protect iron from rusting.

.....  
 .....[1]

- 6 Fig. 6.1 shows two people talking to each other using cordless telephones over a link to a communications satellite.

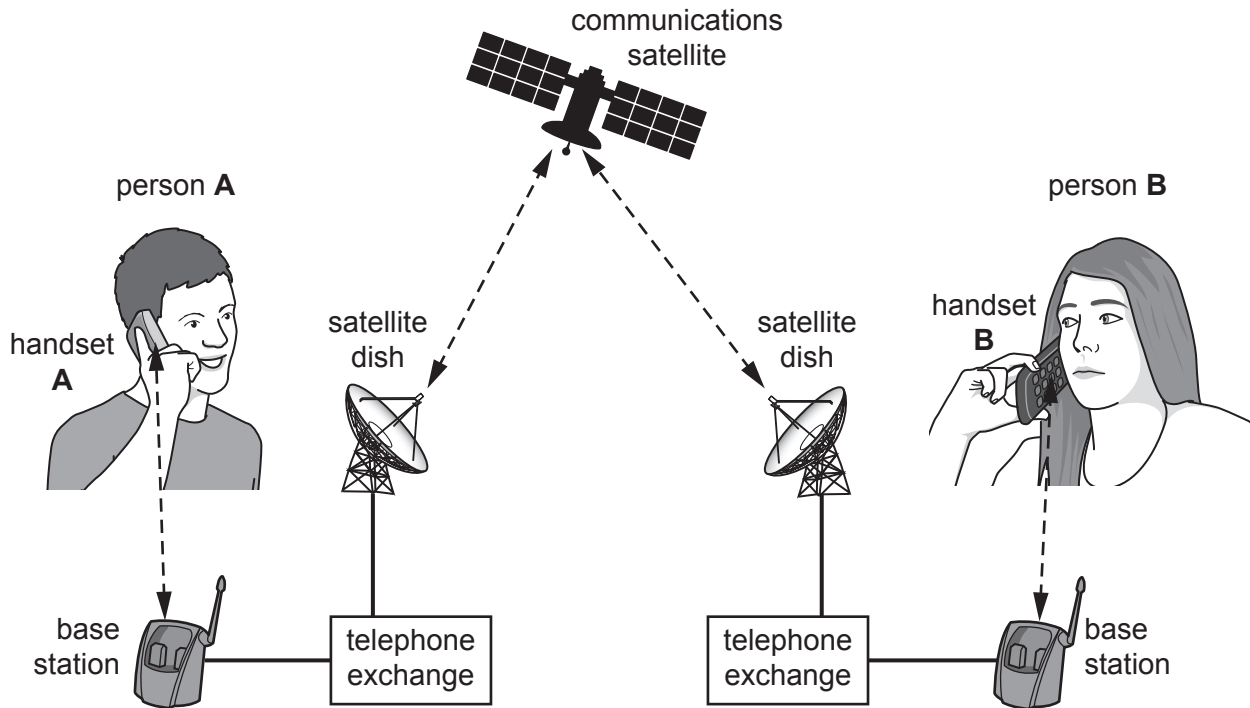


Fig. 6.1

(a) At every stage wave motion is used to transmit the conversation.

- (i) Use information from Fig. 6.1 to complete the following sentence.

..... waves transmit the conversation between person A and handset A. [1]

- (ii) State two different ways in which microwaves or radio waves are used in Fig. 6.1.

1. from ..... to .....
2. from ..... to ..... [2]

(b) Fig. 6.2 shows an incomplete electromagnetic spectrum.

gamma rays			visible light	infra-red waves		
------------	--	--	---------------	-----------------	--	--

Fig. 6.2

On Fig. 6.2 write microwaves and radio waves in their correct positions in the electromagnetic spectrum. [2]

- (c) The communications satellite can become very warm in the day, but become very cold at night.

Explain why these temperature changes happen.

.....  
.....  
.....  
.....[2]

- (d) Explain why the communications satellite cannot use sound waves to communicate with the Earth.

.....  
.....  
.....[1]

7 (a) Table 7.1 shows some facts about processes in living organisms.

In Table 7.1, place a tick (✓) in **all** the boxes where the fact about each process is correct.

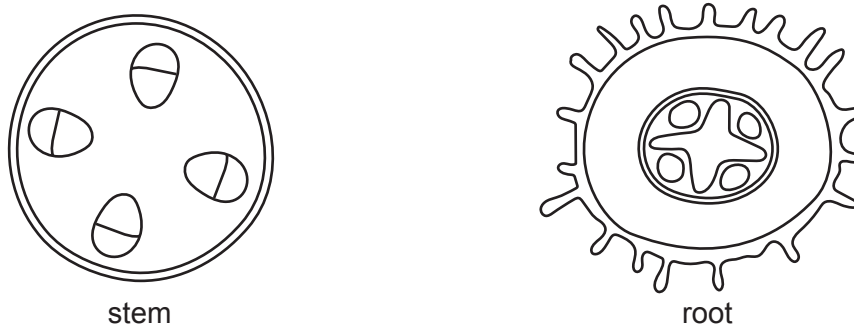
**Table 7.1**

fact	process		
	respiration	photosynthesis	chemical digestion
needs light			
takes place in animals			
needs carbon dioxide			
produces smaller molecules from larger molecules			

[4]

(b) Some red dye in water is used to identify the xylem in a plant. A plant is placed in the red dye for a few hours. After this time, cross-sections of its stem and its root are prepared and viewed under the microscope.

Fig. 7.1 shows the tissues in the stem and in the root.



**Fig. 7.1**

(i) Shade in **one** area in **both** of the drawings in Fig. 7.1 where the red dye can be seen. [2]

(ii) Name the cells which absorb water from the soil. [1]

.....

(iii) Describe **one** function of water in the plant. [1]

.....

.....

(c) Describe the function of phloem in a plant. [1]

.....

.....

8 (a) An atom of chlorine is represented by the symbol:



(i) State the number of electrons, neutrons and protons in this atom.

electrons .....

neutrons .....

protons .....

[2]

(ii) Complete Table 8.1 to show the relative charges and approximate relative masses of electrons, neutrons and protons.

**Table 8.1**

particle	relative charges	approximate relative masses
electrons		
neutrons		
protons		

[2]

(b) Chlorine is a non-metallic element.

State the types of bond that form when chlorine reacts with sodium and with hydrogen.

Explain your answers.

sodium and chlorine .....

explanation .....

.....

hydrogen and chlorine .....

explanation .....

.....

[3]

(c) Chlorine gas is bubbled through solutions of

- sodium bromide,
- zinc chloride,
- magnesium iodide.

Predict which solutions react with chlorine gas.

.....[1]

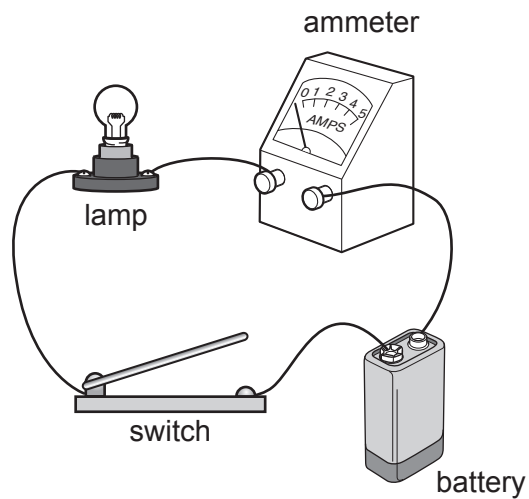
(d) State the test and the positive result for chlorine gas.

test .....

result .....

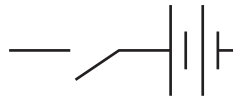
[2]

- 9 Fig. 9.1 shows a simple circuit set up to investigate the electrical properties of a lamp.



**Fig. 9.1**

- (a) (i) On Fig. 9.2 use the correct symbols to complete the diagram for the circuit shown in Fig. 9.1.



**Fig. 9.2**

[2]

- (ii) On Fig. 9.2, using the correct circuit symbol, connect a meter into the circuit that can measure the potential difference across the lamp. [2]



(b) The battery has a voltage of 1.5V, and the reading on the ammeter is 0.6A for the circuit in Fig. 9.1.

(i) Calculate the resistance of the lamp and state the units.

State the formula you use and show your working.

formula

working

resistance = ..... unit ..... [3]

(ii) A second identical lamp is added in series with the lamp in the circuit in Fig. 9.1.

The reading on the ammeter decreases.

Explain why this happens.

.....  
.....  
.....[2]





## The Periodic Table of Elements

Group																	
I	II	III										IV	V	VI	VII	VIII	
3 <b>Li</b> lithium 7	4 <b>Be</b> beryllium 9	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <b>Key</b>            atomic number            atomic symbol            name            relative atomic mass         </div>										5 <b>B</b> boron 11	6 <b>C</b> carbon 12	7 <b>N</b> nitrogen 14	8 <b>O</b> oxygen 16	9 <b>F</b> fluorine 19	10 <b>Ne</b> neon 20
11 <b>Na</b> sodium 23	12 <b>Mg</b> magnesium 24	13 <b>Al</b> aluminium 27	14 <b>Si</b> silicon 28	15 <b>P</b> phosphorus 31	16 <b>S</b> sulfur 32	17 <b>Cl</b> chlorine 35.5	18 <b>Ar</b> argon 40										36 <b>Kr</b> krypton 84
19 <b>K</b> potassium 39	20 <b>Ca</b> calcium 40	21 <b>Sc</b> scandium 45	22 <b>Ti</b> titanium 48	23 <b>V</b> vanadium 51	24 <b>Cr</b> chromium 52	25 <b>Mn</b> manganese 55	26 <b>Fe</b> iron 56	27 <b>Co</b> cobalt 59	28 <b>Ni</b> nickel 59	29 <b>Cu</b> copper 64	30 <b>Zn</b> zinc 65	31 <b>Ga</b> gallium 70	32 <b>Ge</b> germanium 73	33 <b>As</b> arsenic 75	34 <b>Se</b> selenium 79	35 <b>Br</b> bromine 80	36 <b>Kr</b> krypton 84
37 <b>Rb</b> rubidium 85	38 <b>Sr</b> strontium 88	39 <b>Y</b> yttrium 89	40 <b>Zr</b> zirconium 91	41 <b>Nb</b> niobium 93	42 <b>Mo</b> molybdenum 96	43 <b>Tc</b> technetium —	44 <b>Ru</b> ruthenium 101	45 <b>Rh</b> rhodium 103	46 <b>Pd</b> palladium 106	47 <b>Ag</b> silver 108	48 <b>Cd</b> cadmium 112	49 <b>In</b> indium 115	50 <b>Sn</b> tin 119	51 <b>Sb</b> antimony 122	52 <b>Te</b> tellurium 128	53 <b>I</b> iodine 127	54 <b>Xe</b> xenon 131
55 <b>Cs</b> caesium 133	56 <b>Ba</b> barium 137	57–71 lanthanoids	72 <b>Hf</b> hafnium 178	73 <b>Ta</b> tantalum 181	74 <b>W</b> tungsten 184	75 <b>Re</b> rhenium 186	76 <b>Os</b> osmium 190	77 <b>Ir</b> iridium 192	78 <b>Pt</b> platinum 195	79 <b>Au</b> gold 197	80 <b>Hg</b> mercury 201	81 <b>Tl</b> thallium 204	82 <b>Pb</b> lead 207	83 <b>Bi</b> bismuth 209	84 <b>Po</b> polonium —	85 <b>At</b> astatine —	86 <b>Rn</b> radon —
87 <b>Fr</b> francium —	88 <b>Ra</b> radium —	89–103 actinoids	104 <b>Rf</b> rutherfordium —	105 <b>Db</b> dubnium —	106 <b>Sg</b> seaborgium —	107 <b>Bh</b> bohrium —	108 <b>Hs</b> hassium —	109 <b>Mt</b> meitnerium —	110 <b>Ds</b> darmstadtium —	111 <b>Rg</b> roentgenium —	112 <b>Cn</b> copernicium —	114 <b>Fl</b> flerovium —	116 <b>Lv</b> livermorium —				—

lanthanoids

actinoids

57 <b>La</b> lanthanum 139	58 <b>Ce</b> cerium 140	59 <b>Pr</b> praseodymium 141	60 <b>Nd</b> neodymium 144	61 <b>Pm</b> promethium —	62 <b>Sm</b> samarium 150	63 <b>Eu</b> europium 152	64 <b>Gd</b> gadolinium 157	65 <b>Tb</b> terbium 159	66 <b>Dy</b> dysprosium 163	67 <b>Ho</b> holmium 165	68 <b>Er</b> erbium 167	69 <b>Tm</b> thulium 169	70 <b>Yb</b> ytterbium 173	71 <b>Lu</b> lutetium 175
89 <b>Ac</b> actinium —	90 <b>Th</b> thorium 232	91 <b>Pa</b> protactinium 231	92 <b>U</b> uranium 238	93 <b>Np</b> neptunium —	94 <b>Pu</b> plutonium —	95 <b>Am</b> americium —	96 <b>Cm</b> curium —	97 <b>Bk</b> berkelium —	98 <b>Cf</b> californium —	99 <b>Es</b> einsteinium —	100 <b>Fm</b> fermium —	101 <b>Md</b> mendelevium —	102 <b>No</b> nobelium —	103 <b>Lr</b> lawrencium —

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