



CANDIDATE
NAME

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CENTRE
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CANDIDATE
NUMBER

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0653/31

May/June 2022

1 hour 15 minutes

No additional materials are needed.

- 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.

- 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.

- 1 Fig. 1.1 is a diagram of the female reproductive system in humans.

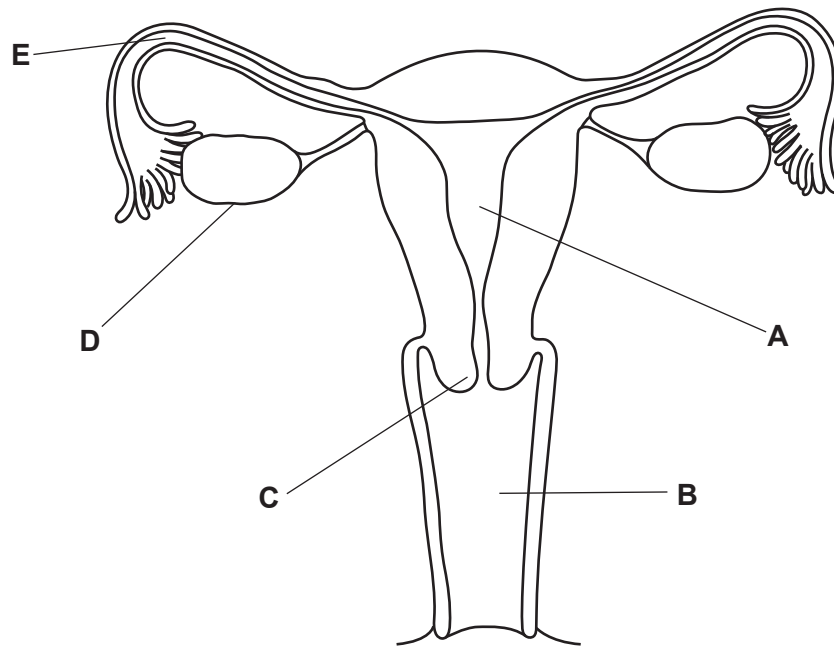


Fig. 1.1

- (a) State the letter in Fig. 1.1 that shows:

the position of the cervix

where fertilisation takes place

where the fetus develops.

[3]

- (b) Describe what happens to the lining of the uterus during the first few days of the menstrual cycle.

.....
 [1]

- (c) Complete these sentences about fertilisation in humans.

The fusion of the nuclei of the egg and sperm produces a fertilised cell called a

.....

This cell divides to form a ball of cells called an

[2]

[Total: 6]

2 (a) An aqueous solution of salt **MX** is made by dissolving solid **MX** in water.

(i) Identify the solvent and the solute in aqueous **MX**.

solute

solvent

[2]

(ii) A student tests separate samples of aqueous **MX**.

The results are shown in Table 2.1.

Complete Table 2.1 by naming the ions that these tests show are in aqueous **MX**.

Table 2.1

test	result	name of ion
add aqueous sodium hydroxide	green precipitate, insoluble in excess	
add aqueous barium ions under acidic conditions	white precipitate	

[2]

(b) A student makes an aqueous solution of **MX** by reacting excess metal **M** with dilute acid **HX**.

The student then separates the excess, unreacted solid metal **M** from the reaction mixture.

(i) Suggest how the student separates solid metal **M** from the reaction mixture.

..... [1]

(ii) State whether this separation process is a chemical change or a physical change.

Explain your answer.

change

explanation

.....

[1]

- (iii) State the effect of increasing the temperature on the rate of this reaction.

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

- (iv) During the reaction between metal **M** and dilute acid **HX**, atoms of **M** become cations.

Explain how atoms become cations.

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

- (v) Suggest what happens to the value of the pH of the reaction mixture during the reaction between excess metal **M** and dilute acid **HX**.

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

[Total: 9]

- 3 Fig. 3.1 shows a man pushing a shopping trolley forwards.



Fig. 3.1

- (a) Fig. 3.2 shows four forces, **P**, **Q**, **R** and **S**, acting on the shopping trolley as the man pushes it.

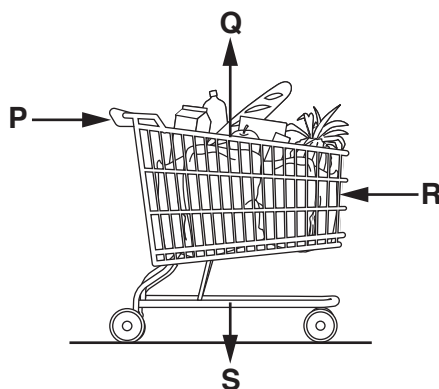


Fig. 3.2

State the name of force **S**.

.....

[1]

- (b) The man pushes the trolley with force **P** = 15 N. The trolley moves at a constant speed.

- (i) State the magnitude of force **R**.

force **R** = N [1]

- (ii) The man increases force **P** to 20 N.

Forces **Q**, **R** and **S** do not change.

Calculate the resultant force on the trolley.

resultant force = N [1]

- (iii) Describe how the change in force **P** affects the motion of the trolley.

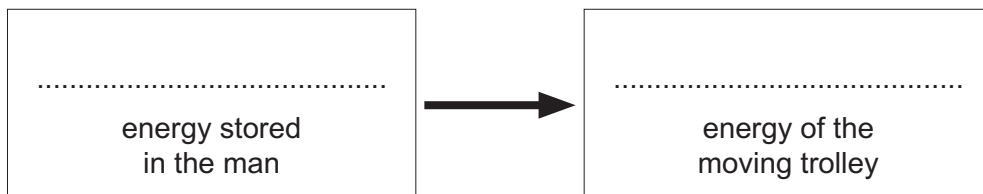
.....
 [1]

- (c) As the man pushes the trolley, he transfers 150 J of energy to the trolley.

- (i) State the work done on the trolley by the man. Give the unit of your answer.

work done = unit [1]

- (ii) Complete the boxes to show the useful energy transfer as the man pushes the trolley.



[2]

- (iii) The man lets go of the moving trolley. The trolley slows down and stops.

Explain why the trolley slows down.

.....

 [2]

[Total: 9]

- 4 (a) Fig. 4.1 is an image of a white blood cell.

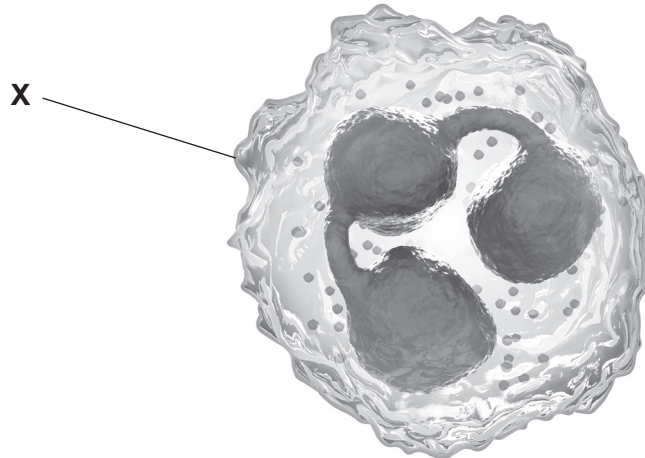


Fig. 4.1

- (i) Identify the part labelled **X** in Fig. 4.1.

..... [1]

- (ii) Use Fig. 4.1 to state **two** reasons why this cell is **not** identified as a plant cell.

1

2 [2]

- (iii) State **one** function of white blood cells.

..... [1]

- (b) A blood sample can be separated into its main components.

Fig. 4.2 is a diagram showing a separated blood sample.

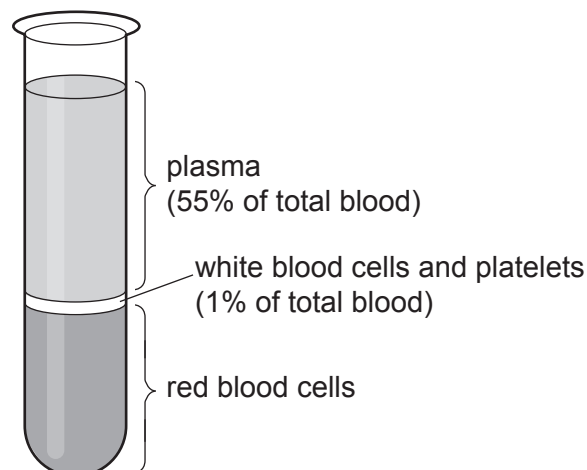


Fig. 4.2

- (i) Calculate the percentage of blood that is red blood cells in Fig. 4.2.

..... % [1]

- (ii) Red blood cells transport oxygen.

Explain why oxygen moves from the lungs into red blood cells.

Use ideas about diffusion in your answer.

.....

 [2]

- (c) Blood plasma transports soluble molecules.

Large insoluble food molecules in our diet are digested into small soluble molecules.

- (i) Circle the name of the soluble molecules proteins are made from.

amino acids **fatty acids** **glycerol** **glucose** **starch**

[1]

- (ii) Complete these sentences about digestion.

Choose words from the list.

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

active **absorption** **anus** **egestion** **excretion**
ingestion **pancreas** **oesophagus** **mechanical**

Food is taken into the mouth by the process of

The food then passes down the to the stomach.

In the stomach there are two types of digestion, chemical and

.....

Food that has been digested passes into the blood by the process of

.....

[4]

[Total: 12]

5 (a) Fossil fuels release heat energy during combustion.

(i) State the name given to any chemical reaction that releases heat energy.

..... [1]

(ii) State the name of the fossil fuel in which methane is the main constituent.

..... [1]

(iii) Complete the dot-and-cross diagram in Fig. 5.1 to show all the outer shell electrons in a molecule of methane.

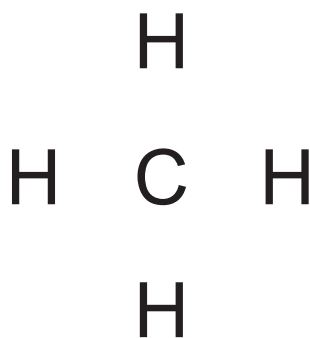


Fig. 5.1

[2]

(b) Magnesium burns in pure oxygen to form compound **Y** only.

Compound **Y** is a white solid base that reacts with dilute sulfuric acid to form compound **Z** and water only.

(i) State whether magnesium is oxidised or reduced when it burns.

Explain your answer.

.....

..... [1]

(ii) Identify compound **Y** and compound **Z**.

compound **Y**

compound **Z**

[2]

(iii) Describe **two** physical properties of magnesium.

1

2

[2]

[Total: 9]

6 (a) Electromagnetic waves transfer energy through space from the Sun to the Earth.

- (i) State whether this transfer of energy through space is by conduction, convection or radiation.

Explain your answer.

.....

 [2]

- (ii) Fig. 6.1 shows an incomplete electromagnetic spectrum.

The Sun emits waves in all parts of the electromagnetic spectrum.

Complete Fig. 6.1 to show all parts of the electromagnetic spectrum.

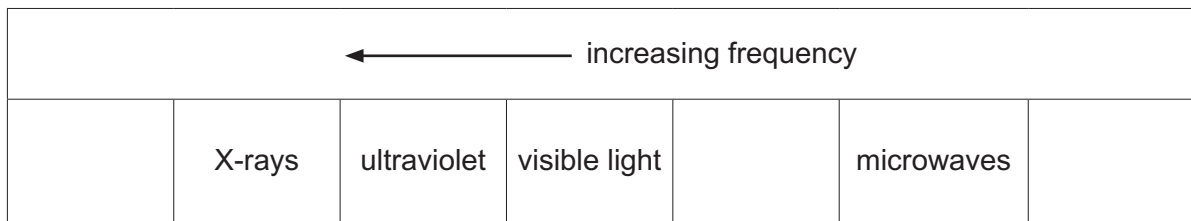


Fig. 6.1

[2]

- (iii) Visible light waves take 8 minutes to travel from the Sun to the Earth.

Suggest how long it takes for ultraviolet waves to travel from the Sun to the Earth.

Give a reason for your answer.

time taken

reason

[1]

- (b) Fig. 6.2 shows the Sun shining on a puddle of water. A student sees an image of the Sun in the puddle of water.

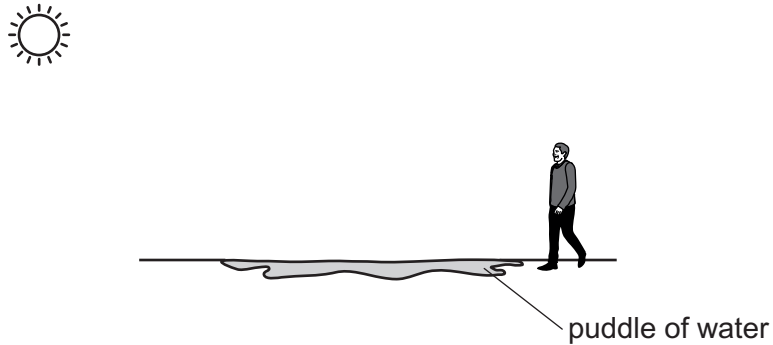


Fig. 6.2

- (i) The puddle acts as a plane mirror.

On Fig. 6.2, draw a ray diagram to show how the student can see an image of the Sun in the puddle.

Your diagram should include the position of the image of the Sun.

[3]

- (ii) Explain, in terms of water molecules, what happens as the Sun transfers energy to the puddle and the water in the puddle dries up.

.....

.....

..... [2]

[Total: 10]

- 7 (a) Fig. 7.1 shows part of a food web from the ocean.

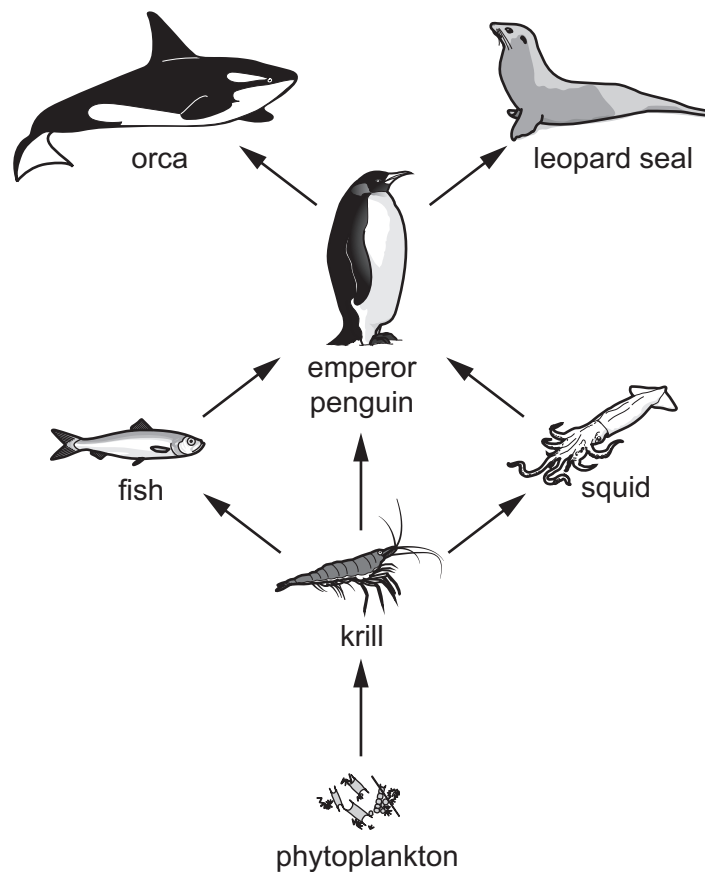


Fig. 7.1

- (i) Phytoplankton are producers.
Define the term producer.

.....
 [2]

- (ii) Identify a primary consumer in Fig. 7.1.

..... [1]

- (iii) Identify **two** organisms eaten by emperor penguins in Fig. 7.1.

1

2

[1]

- (iv) Orcas also eat fish.

Draw **one** arrow on Fig. 7.1 to show this feeding relationship. [1]

(b) Fig. 7.2 shows part of the carbon cycle.

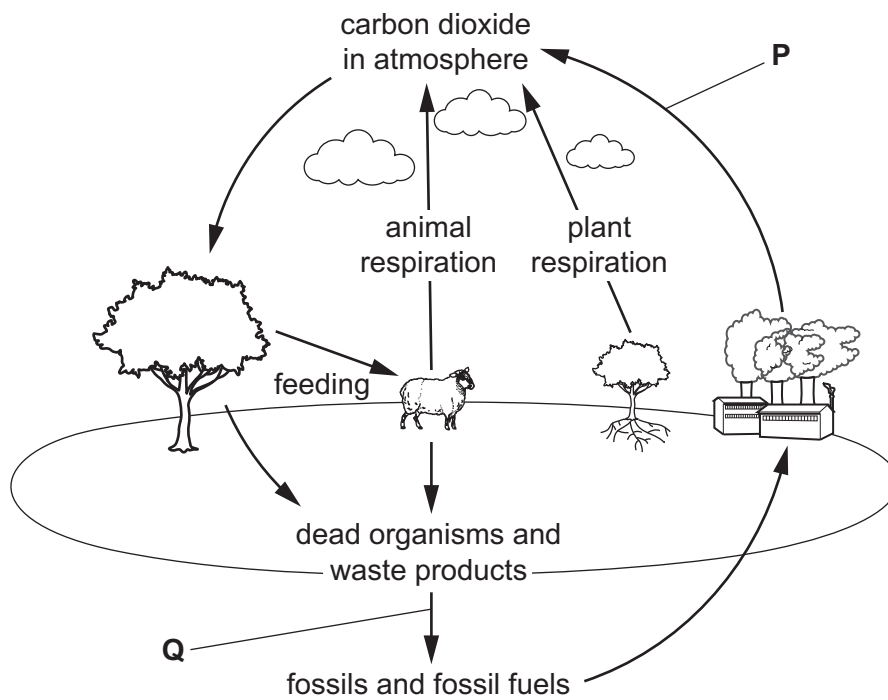


Fig. 7.2

(i) Identify processes **P** and **Q** in Fig. 7.2.

P

Q

[2]

(ii) Deforestation increases the concentration of carbon dioxide in the atmosphere.

List **two other** undesirable effects of deforestation.

1

2

[2]

[Total: 9]

- 8 (a) Lithium, sodium and potassium are metals in Group I of the Periodic Table.

Chlorine, bromine and iodine are halogens in Group VII of the Periodic Table.

Helium, neon and argon are elements in Group VIII of the Periodic Table.

- (i) State the trend in the density of the elements going down Group I.

..... [1]

- (ii) State the trend in the colour of the elements going down Group VII.

..... [1]

- (iii) Identify **one** similarity between the elements in Group VIII.

..... [1]

- (b) Aluminium, calcium, iron and sodium are in different groups of the Periodic Table.

Place these metals in order of reactivity, from most to least reactive.

.....	most reactive
.....	↓
.....	
.....	least reactive

[2]

- (c) An atom of sodium is represented as shown.



Deduce the number of protons and the number of neutrons in this atom.

protons

neutrons

[2]

- (d) State **one** use of helium.

..... [1]

[Total: 8]

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- 9 (a) Complete the following sentences using the terms shown.

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

current

positive charge

ohms

resistance

series

volts

A flow of electric charge is called a

An ammeter is used to measure

A potential difference is measured in

[3]

- (b) Fig. 9.1 shows an electric circuit.

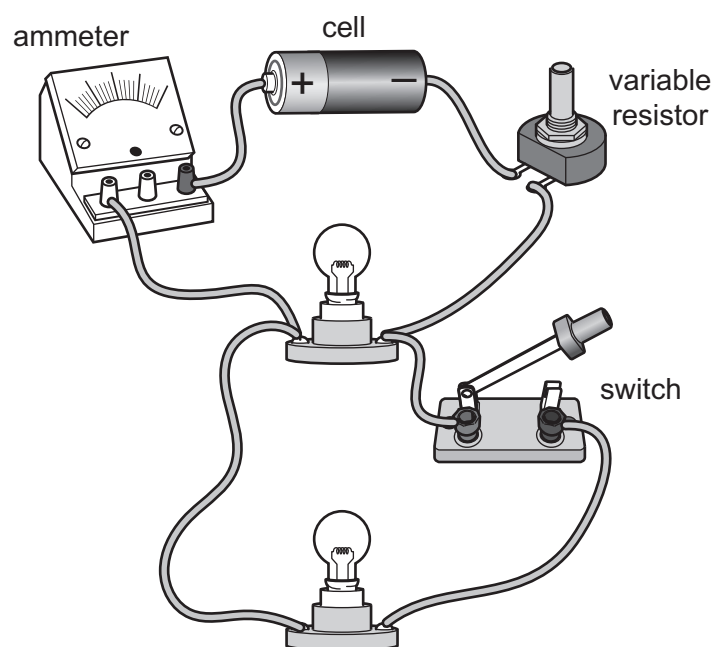


Fig. 9.1

- (i) Fig. 9.2 shows an incomplete circuit diagram for the circuit in Fig. 9.1.

On Fig. 9.2, complete the circuit diagram.

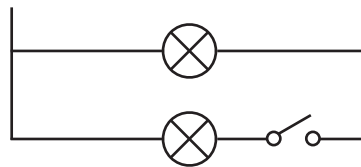


Fig. 9.2

[3]

- (ii) When the switch is off, the reading on the ammeter is 0.5A.

When the switch is on, the reading on the ammeter increases.

Explain why the reading on the ammeter increases.

.....

.....

..... [2]

[Total: 8]

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The Periodic Table of Elements

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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 actinoids	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	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 —	118 Ts tennessine —	119 Og oganesson —	120 Nh nihonium —	121 Ds darmstadtium —	122 Nh nihonium —	123 Nh nihonium —	124 Nh nihonium —	125 Nh nihonium —	126 Nh nihonium —	127 Nh nihonium —	128 Nh nihonium —	129 Nh nihonium —	130 Nh nihonium —	131 Nh nihonium —	132 Nh nihonium —	133 Nh nihonium —	134 Nh nihonium —	135 Nh nihonium —	136 Nh nihonium —	137 Nh nihonium —	138 Nh nihonium —	139 Nh nihonium —	140 Nh nihonium —	141 Nh nihonium —	142 Nh nihonium —	143 Nh nihonium —	144 Nh nihonium —	145 Nh nihonium —	146 Nh nihonium —	147 Nh nihonium —	148 Nh nihonium —	149 Nh nihonium —	150 Nh nihonium —	151 Nh nihonium —	152 Nh nihonium —	153 Nh nihonium —	154 Nh nihonium —	155 Nh nihonium —	156 Nh nihonium —	157 Nh nihonium —	158 Nh nihonium 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nihonium —	437 Nh nihonium —	438 Nh nihonium —	439 Nh nihonium —	440 Nh nihonium —	441 Nh nihonium —	442 Nh nihonium —	443 Nh nihonium —	444 Nh nihonium —	445 Nh nihonium —	446 Nh nihonium —	447 Nh nihonium —	448 Nh nihonium —	449 Nh nihonium —	450 Nh nihonium —	451 Nh nihonium —	452 Nh nihonium —	453 Nh nihonium —	454 Nh nihonium —	455 Nh nihonium —	456 Nh nihonium —	457 Nh nihonium —	458 Nh nihonium —	459 Nh nihonium —	460 Nh nihonium —	461 Nh nihonium —	462 Nh nihonium —	463 Nh nihonium —	464 Nh nihonium —	465 Nh nihonium —	466 Nh nihonium —	467 Nh nihonium —	468 Nh nihonium —	469 Nh nihonium —	470 Nh nihonium —	471 Nh nihonium —	472 Nh nihonium —	473 Nh nihonium —	474 Nh nihonium —	475 Nh nihonium —	476 Nh nihonium —	477 Nh nihonium —	478 Nh nihonium —	479 Nh nihonium —	480 Nh nihonium —	481 Nh nihonium —	482 Nh nihonium —	483 Nh nihonium —	484 Nh nihonium —	485 Nh nihonium —	486 Nh nihonium —	487 Nh nihonium —	488 Nh nihonium —	489 Nh nihonium —	490 Nh nihonium —	491 Nh nihonium —	492 Nh nihonium —	493 Nh nihonium —	494 Nh nihonium —	495 Nh nihonium —	496 Nh nihonium —	497 Nh nihonium —	498 Nh nihonium —	499 Nh nihonium —	500 Nh nihonium —	501 Nh nihonium —	502 Nh nihonium —	503 Nh nihonium —	504 Nh nihonium —	505 Nh nihonium —	506 Nh nihonium —	507 Nh nihonium —	508 Nh nihonium —	509 Nh nihonium —	510 Nh nihonium —	511 Nh nihonium —	512 Nh nihonium —	513 Nh nihonium —	514 Nh nihonium —	515 Nh nihonium —	516 Nh nihonium —	517 Nh nihonium —	518 Nh nihonium —	519 Nh nihonium —	520 Nh nihonium —	521 Nh nihonium —	522 Nh nihonium —	523 Nh nihonium —	524 Nh nihonium —	525 Nh nihonium —	526 Nh nihonium —	527 Nh nihonium —	528 Nh nihonium —	529 Nh nihonium —	530 Nh nihonium —	531 Nh nihonium —	532 Nh nihonium —	533 Nh nihonium —	534 Nh nihonium —	535 Nh nihonium —	536 Nh nihonium —	537 Nh nihonium —	538 Nh nihonium —	539 Nh nihonium —	540 Nh nihonium —	541 Nh nihonium —	542 Nh nihonium —	543 Nh nihonium —	544 Nh nihonium —	545 Nh nihonium —	546 Nh nihonium —	547 Nh nihonium —	548 Nh nihonium —	549 Nh nihonium —	550 Nh nihonium —	551 Nh nihonium —	552 Nh nihonium —	553 Nh nihonium —	554 Nh nihonium —	555 Nh nihonium —	556 Nh nihonium —	557 Nh nihonium —	558 Nh nihonium —	559 Nh nihonium —	560 Nh nihonium —	561 Nh nihonium —	562 Nh nihonium —	563 Nh nihonium —	564 Nh nihonium —	565 Nh nihonium —	566 Nh nihonium —	567 Nh nihonium —	568 Nh nihonium —	569 Nh nihonium —	570 Nh nihonium —	571 Nh nihonium —	572 Nh nihonium —	573 Nh nihonium —	574 Nh nihonium —	575 Nh nihonium —	576 Nh nihonium —	577 Nh nihonium —	578 Nh nihonium —	579 Nh nihonium —	580 Nh nihonium —	581 Nh nihonium —	582 Nh nihonium —	583 Nh nihonium —	584 Nh nihonium —	585 Nh nihonium —	586 Nh nihonium —	587 Nh nihonium —	588 Nh nihonium —	589 Nh nihonium —	590 Nh nihonium —	591 Nh nihonium —	592 Nh nihonium —	593 Nh nihonium —	594 Nh nihonium —	595 Nh nihonium —	596 Nh nihonium —	597 Nh nihonium —	598 Nh nihonium —	599 Nh nihonium —	600 Nh nihonium —	601 Nh nihonium —	602 Nh nihonium —	603 Nh nihonium —	604 Nh nihonium —	605 Nh nihonium —	606 Nh nihonium —	607 Nh nihonium —	608 Nh nihonium —	609 Nh nihonium —	610 Nh nihonium —	611 Nh nihonium —	612 Nh nihonium —	613 Nh nihonium —	614 Nh nihonium —	615 Nh nihonium —	616 Nh nihonium —	617 Nh nihonium —	618 Nh nihonium —	619 Nh nihonium —	620 Nh nihonium —	621 Nh nihonium —	622 Nh nihonium —	623 Nh nihonium —	624 Nh nihonium —	625 Nh nihonium —	626 Nh nihonium —	627 Nh nihonium —	628 Nh nihonium —	629 Nh nihonium —	630 Nh nihonium —	631 Nh nihonium —	632 Nh nihonium —	633 Nh nihonium —	634 Nh nihonium —	635 Nh nihonium —	636 Nh nihonium —	637 Nh nihonium —	638 Nh nihonium —	639 Nh nihonium —	640 Nh nihonium —	641 Nh nihonium —	642 Nh nihonium —	643 Nh nihonium —	644 Nh nihonium —	645 Nh nihonium —	646 Nh nihonium —	647 Nh nihonium —	648 Nh nihonium —	649 Nh nihonium —	650 Nh nihonium —	651 Nh nihonium —	652 Nh nihonium —	653 Nh nihonium —	654 Nh nihonium —	655 Nh nihonium —	656 Nh nihonium —	657 Nh nihonium —	658 Nh nihonium —	659 Nh nihonium —	660 Nh nihonium —	661 Nh nihonium —	662 Nh nihonium —	663 Nh nihonium —	664 Nh nihonium —	665 Nh nihonium —	666 Nh nihonium —	667 Nh nihonium —	668 Nh nihonium —	669 Nh nihonium —	670 Nh nihonium —	671 Nh nihonium —	672 Nh nihonium —	673 Nh nihonium —	674 Nh nihonium —	675 Nh nihonium —	676 Nh nihonium —	677 Nh nihonium —	678 Nh nihonium —	679 Nh nihonium —	680 Nh nihonium —	681 Nh nihonium —	682 Nh nihonium —	683 Nh nihonium —	684 Nh nihonium —	685 Nh nihonium —	686 Nh nihonium —	687 Nh nihonium —	688 Nh nihonium —	689 Nh nihonium —	690 Nh nihonium —	691 Nh nihonium —	692 Nh nihonium —	693 Nh nihonium —	694 Nh nihonium —	695 Nh nihonium —	696 Nh nihonium —	697 Nh nihonium —	698 Nh nihonium —	699 Nh nihonium —	700 Nh nihonium —	701 Nh nihonium —	702 Nh nihonium —	703 Nh nihonium —	704 Nh nihonium —	705 Nh nihonium —	706 Nh nihonium —	707 Nh nihonium —	708 Nh nihonium —	709 Nh nihonium —	710 Nh nihonium —	711 Nh nihonium —	712 Nh nihonium —	713 Nh nihonium —	714 Nh nihonium —	715

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
	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 dm³ at room temperature and pressure (r.t.p.).